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The Changing Cupola

The development of the cupola has been progressive, but never spectacular. It is truthful to state that the art of its operation is such that a skilled man using an old-fashioned plant can often achieve results of a very high order. Indeed, his efforts may be so rewarding that further economies which would normally follow the installation of a more modern furnace would be difficult to realize. A new book, "The Cupola and Its Operation,"* published by the American Foundrymen's Society, neatly puts the situation in the following phrase "A new cupola always affects a great saving in fuel but it is hard to find the fuel (saved) at the end of the year. A little more practical knowledge will often enable the foundryman to find the fuel saved and the price of the new cupola besides." This raises the question as to what is practical knowledge. If it be the sole perquisite of an inarticulate workman, then it is only of value when this man is available, and as such constitutes a pretty poor insurance risk.

A good practical man will, *inter alia*, insist that the bed must be evenly lit; that it should be maintained at a fixed level during the whole of the melting period; that a soft blast should be used, and so forth. These are nebulous conditions, difficult of interpretation by anyone other than a man constantly at the elbow of the furnaceman. How much more sensible it is to take each pronouncement by the practical man and where possible to convert it into actual figures.

The conditions have changed so radically since the last war, because the raw materials—coke, pig-iron and scrap—are now really expensive, and not only in the interest of the foundry industry but also in the national interest, they must be used economically. By instrumentation and simple measurements related to ordinary cupolas, sufficient data can be obtained to enable comparison to be made with the modern plants now available, and moreover the "fuel (saved) at the end of the year" will be a tangible quantity. One cause of a stock discrepancy at the end of the year is to be found where manual weighing or volume measurement is practised. It is due to the inherent desire, like the grocer, to give good measure "and then a bit over, for luck." These small but many-times-repeated over-weights can result in serious shortage in the materials balance-sheet. Patching material, too, is now no longer a negligible item of melting costs, and a survey made by the Institute of British Foundrymen many years ago revealed almost unbelievable variations in the quantity used per ton of metal melted. A final test of efficiency suggested to owners of small cupolas is that they should ascertain just how many control values they can measure during the periodic operation of their furnaces, and compare them with the data which the suppliers of modern plant can normally furnish. It is obvious, to close observers of foundry practice, that the traditional cupola is bound to undergo radical changes in the future. Not only the cost of raw materials, but also the selling price of castings reflects entirely new conditions; regarded from this aspect, the melting plant should be commensurate therewith and not have the qualities of an apparatus only suited to a place in South Kensington museum.

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*See page 720 of this issue.

Employer's Liability Refuted

A workman injured in an accident in an iron foundry lost his claim for damages against his employers in the Court of Session on November 23 because the act complained of was done by a fellow-employee during his meal hour, when he went to discuss football with the pursuer. Anthony Houston, machine moulder, sued Babcock & Wilcox, Limited, ironfounders, of Glasgow, for £2,000 in respect of injury to his back. He contended that in May, 1952, while he was in the course of his employment with the defenders, a stack of binders (component parts of moulds), fell, striking him on the back and knocking him to the ground. He blamed two fellow-servants—Michael McLaughlin and Anthony O'Donnell—for whose actions he said the defenders were responsible. They had, he said, stacked binders in such a way that they were liable to collapse.

At the end of the evidence for the pursuer, Lord Guthrie, on the motion of defending counsel, asked the jury to leave and heard counsel submit that there was no evidence in the case which would entitle a reasonable jury to find that the defenders were responsible for any accident which befell the pursuer. Following a debate, his lordship gave a judgment in which he held that O'Donnell, according to his evidence, went to the pursuer's place of work during his own meal hour in order to discuss football with the pursuer and was there for a matter of 10 min., in the course of which he placed binders on the stack without anyone having instructed him to do so. What O'Donnell did was entirely voluntary and unauthorized, and the defenders' vicárious responsibility did not extend to acts done by O'Donnell in the circumstances disclosed by the evidence. The pursuer's counsel indicated that he would appeal against the ruling. After he had explained to the jury that in their absence he had decided, on hearing counsel's submissions, to withdraw the case from their consideration, Lord Guthrie directed them to return a formal verdict for the defenders.

Small Consignments Delayed

SINCE the break-up of the haulage division of British Road Services material such as non-ferrous tubes and bars were no longer transported by the parcels service and therefore had now to go in small consignments by rail, it was stated by Mr. C. E. Jordan, chairman of the transport committee of the Birmingham Chamber of Commerce, at its meeting on November 22. The Chamber decided to collect from its members evidence about delays in the transit of small consignments of goods by rail. One member firm, he said, had made "a meticulous study" of the matter, proving that the average delivery time was 5½ days for such consignments. In some cases delivery took as long as 23 days. Firms now were not carrying the stocks they used to and wanted small consignments more frequently. "It is intolerable these small consignments should take so long in transit," Mr. Jordan said. Mr. J. E. Belliss, who queried the possibility of reintroducing the pre-war Green Arrow express service, was told by Mr. R. P. Davis, district goods superintendent, British Railways, that although the service had been reintroduced for export traffic, the Transport Commission did not consider the time opportune for extending it to internal traffic.

It was also emphasized that there was delay in consignments reaching the ports, arriving late and so missing ships and jeopardizing export trade. On the suggestion of Professor Gilbert Walker, the Chamber decided to gather statistics on the matter.

Pay Decision May Close Scots Works

The Industrial Disputes Tribunal which recently heard the dispute between Alexander Dey & Company, Limited, engineers and millwrights, of Huntly, and the A.E.U. over a pay increase claim, has given a decision in favour of the Union. The Tribunal's award is that the wages of the workers shall be increased in accordance with the terms of the agreement between the Confederation of Shipbuilding & Engineering Unions and the Engineering & Allied Employers' National Federation of April 13 last, *i.e.*, that wages which were being paid to the workers prior to April 5 this year shall be increased by 8s. 6d. per week.

This award, the Tribunal adds, shall have effect as from the beginning of the first full pay period following May 26 this year. (The Union had asked that the wage increase should be retrospective to April 5). At the hearing, Mr. William Petrie, divisional organizer, Dundee, agreed that Alexander Dey, Limited, were not members of the Federation, which entered into the agreement, but the A.E.U. claimed that the firm were in the engineering industry and employees were entitled to receive the benefits concluded between the unions and the employers' federation.

The Tribunal's award may lead to the closure of the works and the grim prospect of unemployment before Christmas for 17 or 18 men. This was hinted by Mr. R. G. Morrison, managing director of the firm, on November 17, who said he would rather close his works than be dictated to. With the support of the Tribunal, the union was enforcing the payment of uneconomic and uncompetitive wages which the business could not support and the company was left with no apparent alternative than to discontinue employing direct labour.

Mr. Morrison, a Glasgow man who left London three years ago to run the business in Huntly, concluded: "As the unions are taking into their hands the important functions of management, without at the same time accepting the responsibilities that go with them, I feel there is no alternative but to leave the matter to them to solve. They are coming along to tell me something I just can't do and am not going to do." He added: "After all, if a business cannot be operated within the limits of justice all round, there is not much point in trying to go on." Only two men on his staff are union members, said Mr. Morrison, and only one was affected by the claim heard by the Tribunal.

Imperial Foundry Expansion

Several hundred thousand pounds are to be spent on Imperial Foundry, Limited, at Leamington, in alterations designed to increase output and improve working conditions. The foundry, which belongs to the Ford Motor Company, Limited, will, it is claimed, become the most up-to-date in the Midlands, and second only in this country to the new one to be built at Dagenham. It is anticipated that the present labour force of 1,000 will be more than doubled. The recently announced development of working arrangements between the Ford Motor Company, Limited, and the Ransomes, Sims and Jefferies Company, Limited, means that agricultural implements will cease to be made at Leamington. The factory there will concentrate on contributing towards the expanding production of cars, tractors and commercial vehicles, which is anticipated from the Dagenham works. At present, the Leamington output of castings is equal to 25 per cent. of the total used at Dagenham. The expenditure on the Leamington foundry is part of the overall expansion of the Ford Motor Company in this country.

Gas and Oxide Contents of Castings from Cupola-melted Metal, and Influence of the Materials Charged*

By P. Bardenheuer and P. von der Forst

Report of the Blast Furnace Committee of the Verein Deutscher Eisenhüttenleute. *The report covers the following subjects: The raw materials used for iron castings; defects in the castings caused by gases. Influence upon gases and oxides of the melting materials charged. Distinction between easily-reacting metallic oxides and slowly-reacting oxides of silicon and aluminium. Influence of oxides on manganese: sulphur ratio. Conclusions to be drawn from the test results. Extent of the solidification range and the casting defects.*

For about 25 years, the hot-extraction method and the isolation-of-residues method have been employed for the determination of gas and oxide content in steel. The application of these techniques has led to a general increase in the knowledge of the effects of these items in steel and an improvement in steel metallurgy generally.

These analysis techniques have not, however, been applied to cast iron as widely as could be desired. Until a few years ago, only occasional attempts had been made in this direction. Recently, however, some work has been published[1] which covers the application of the techniques to the analysis of pig-iron and cast iron, and in particular the influence of gas content and the compounds formed thereby on the properties of cast-iron alloys. Such an investigation was particularly called for in the years following the second world war when the raw-material situation was difficult and much unsatisfactory scrap had to be pressed into service. Blast-furnace operators and ironfounders became particularly concerned with a large number of difficult questions concerning the effect of raw materials on cast-iron quality.

The first results, mainly devoted to a study of the effects of oxides and gases in cast iron, have been published only recently by H. Siegel[2] and by J. Willems, R. Opitz, M. Paschke, and C. W. Pfannenschmidt.[3] This work was undertaken with the hope that failures in cast iron due to gas content could be correlated with the raw materials used.

Changing Pattern

These problems are of comparatively recent occurrence. In the old days, when castings were made from iron smelted directly in the charcoal blast-furnace, different materials were charged. When direct casting was abandoned on the introduction of the cupola and other remelting furnaces, it became possible to make castings from mixtures of different raw materials. The requirements for good-quality cast iron became fairly quickly standardized and cast iron has been an important engineering material for many years. In the production of good-quality cast iron, however, the quantity of pig-iron used has declined, and the quantity of scrap cast-iron and scrap steel has steadily increased. In some cases nowadays, only 10-20 per cent. by weight, or even less of virgin pig-iron, is charged to the remelting furnace.

This decline in pig-iron usage brought a number of defects in its wake, for example, porosity, cracking, hot-tearing and blowholes. Such defects occur very frequently in the malleable-iron foundry, where castings are made from some 50 per cent. of circulating (iron) scrap, together with quantities of steel scrap. The troubles have necessitated the use of deeper and heavier feeder heads and yield drops accordingly. Although it is obvious that these defects are due to gases, the origin of the gases is not clear. It is not known if the gases are dissolved or are reaction gases. They may have their origin in the melting material or in the furnace atmosphere. Although the percentage of pig-iron in the charges is very small compared with that of scrap, the fault has been assigned to the constitution of the pig-iron.

Earlier Results

P. Bardenheuer and W. Bottenberg[4] investigated the expansion during solidification due to oxygen and hydrogen gases, by means of shrinkage tests. It was found that in six out of eight samples remelted in a high-frequency furnace at as low as possible a temperature, the oxygen and hydrogen contents were very low, while in samples remelted at higher temperatures, the total oxygen and hydrogen content was higher. It can be seen, therefore, that the temperature is of importance.

J. Willems *et al*,[3] gave valuable information on the behaviour of oxygen and nitrogen in cast iron. They found that by remelting fine-grain pig-iron for producing malleable iron or grey cast iron in different furnaces, considerable variations in the oxygen and nitrogen contents was obtained. The pig-iron contained 0.013 O_2 and 0.0036 N_2 per cent. The oxygen content decreased to 0.0017 and 0.0030 per cent. (a mean of 0.0024 per cent.) when melting was carried out in a pulverized-fuel-fired rotary furnace, to 0.0027 and 0.0054 per cent (a mean of 0.0043 per cent.) in a hot-blast cupola, and to 0.0022 and 0.0140 per cent. (a mean of 0.0054 per cent.) in a cold-blast cupola. The nitrogen content increased considerably when the samples were melted in the rotary furnace and cold-blast cupola, and remained unchanged in the hot-blast cupola. It can be seen therefore that the

* Translated from *Stahl und Eisen*, and slightly abridged

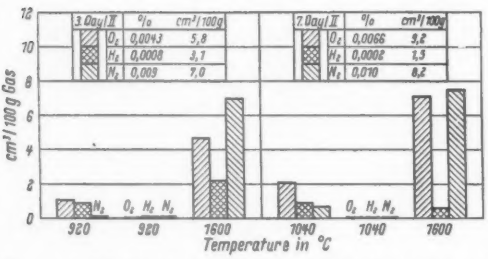


FIG. 1.—*Malleable iron, as-cast, having low gas content.*

oxygen content of the cast iron depends on the FeO content of the slag, and it is pointed out that the oxygen content will decrease with increase in temperature.

The increased use of scrap might lead to the presence of rust in the cupola, that is, a certain amount of hydrogen which is chemically bound in the rust will be picked up by the iron. The rust will be introduced deep into the furnace and the hydrogen evolved during the dissociation of the iron hydroxide will be taken up by the liquid iron. The time available is too short for reducing the oxides present in the rust even in a highly reducing atmosphere. A case in point will next be described.

Cases in Point

In 1946 a large ironworks in Lower Saxony experienced losses in iron castings which amounted to almost half their output, due to the above described defects. The author, P. Bardenheuer, was asked to investigate the case and found that about 40 per cent. of small scrap covered heavily with rust was regularly charged into the furnace. As there was a shortage of pig-iron, this scrap was very valuable, and so it was arranged to have it de-rusted in a cleaning drum before being charged. This reduced the percentage of rust on the scrap from 2 to 5 per cent. that was in the charge to 1 per cent. The effect was striking, the molten iron, after the removal of the rust, could be handled excellently in the foundry, and the number of rejected castings fell to only a few per cent. This showed that the rust entering the cupola could be regarded as a dangerous poison.

H. Siegel[2], in the publication already referred to, points out that special attention is paid to rust on steel scrap at the works of the Duisburger Kupferhütte and Gussstahlwerks Wittmann at Hagen-Haspe. A number of tests were carried out over a period of six weeks, sampling being done on 13 days. The metal for casting was made from 50 per cent. ordinary scrap, 30 per cent. steel scrap and 20 per cent. pig-iron, to produce malleable iron. During the experiment, two sorts of pig-iron, the compositions of which are shown in Table I, were twice exchanged. On most days, small-size cupola steel scrap more or less heavily rusted was charged. To show the effect of rust clearly, on one day, only rust-free rolling-mill scrap was used. The melted metal possessed the following percentage composition—C 3.06, Si 0.83, Mn 0.50, P 0.084, and S 0.175. To determine the gas and oxide contents sand-cast samples were poured and, from the same ladle, test-pieces were poured into steel moulds, to provide samples for analysing the gas and oxide content of the molten metal. Samples were assayed by the hot-extraction process. This double sampling was employed because tests have shown that the gas and oxide content of sand-cast metal can be markedly higher than the gas content of the same metal when liquid. Table II shows the extent to which this can occur.

The malleable-iron samples showed that rusty scrap had a very significant effect on the gas content of the metal. When scrap with very little rust was used, the oxygen content of the castings (taken prior to annealing) was of the same order as that of the pig-iron, but when rusty scrap was melted, this content could be nearly double. The nitrogen content increased in the same way, in one case to double the amount, and in another to treble the value when rust-free scrap was melted. The hydrogen content of the raw castings was not much higher than that of the pig-iron, but increased to twice the amount in the case where heavily-rusted scrap was charged. Again, higher gas contents were found in the samples solidified in a sand mould. It was also found that the FeO content of the slag increased, while the manganese content of the iron decreased in the presence of large amounts of rust.

Effect of Temperature on Reactions

The hot-extraction method for the determination of the gas content when carried out at varying temperatures gives valuable information on the effect of rust. Two samples were each degassed for 15 minutes at 920, 1,020 and 1,600 deg. C. Results are given in Figs. 1 and 2. Fig. 1 shows gas contents of samples from a slightly-rusted scrap charge and Fig. 2 the much higher gas contents due to a heavily-rusted charge. It is seen therefore that oxides due to highly-rusted scrap charges react with the carbon at low temperatures to form CO, while the oxides due to clean-scrap charges only react at

FIG. 2.—*As-cast malleable with high gas content.*

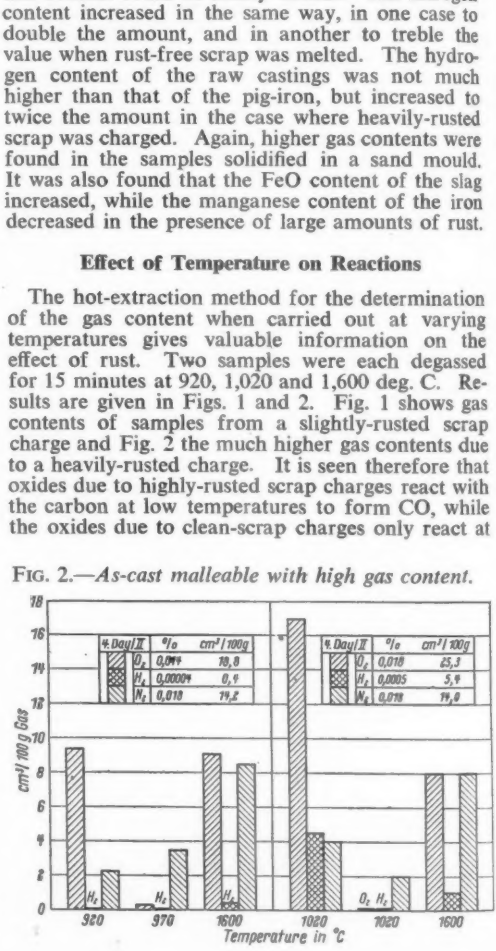


TABLE I.—*Compositions of the Two Types of Pig-iron Investigated.*

Pig-iron.	Composition, per cent.						H_2 cm.³ per 100 g.	N_2 per cent.
	C	Si	Mn	P	S	O_2		
A ..	3.82	2.78	0.70	0.069	0.023	0.012	6.4	0.0055
B ..	4.00	2.75	0.32	0.11	0.025	0.0135	11.2	0.006

higher temperatures, *i.e.*, above the melting point of the iron. The nitrogen content also increases with increase in the rust, its behaviour being similar to that of oxygen. The results indicate the presence of various nitrides, which dissociate at different temperatures. Fig. 3 shows that the pig-iron contained oxides which reacted with the carbon only at higher temperature and also nitrogen which dissociated at higher temperature.

The results were compared with those obtained with the residue-analysis method; Table III gives the composition of the oxides. A metallographic examination of the remaining sample showed that the FeO-rich sample of the fourth day contained numerous coloured metal silicates and dark metal oxides, while that of the seventh day showed colourless, transparent silicates. An optical analysis (for crystal structure and colour) gave tridymite, mullite and, occasionally, quartz. The amorphous particles consisted on glassy SiO_2, and the natural viridine (Al, Fe, Mn) SiO_5 and a few of the Ca-Mg silicate series.

Further Experiments

Another test was carried out to obtain more information on the easily-reduced and difficult-to-reduce oxides. The oxygen content from the difficult-to-reduce oxides was determined for all samples (all days). The results are shown in Fig. 4 by the thick black line (*c*), the mean content being 0.0052 per cent. O_2. Maxima and minima oxygen contents of the chill-mould samples and sand-cast samples are also included for purposes of comparison. Mean total values are 0.0114 per cent. O_2 for the first, and 0.0069 per cent. O_2 for the second. Subtracting the mean oxygen content of the difficult-to-reduce oxides, an oxygen content of the easily-reduced oxides of 0.0062 per cent. O_2 is obtained, while that for the sand-cast samples is only 0.0017 per cent. O_2. The following conclusions can be drawn:—

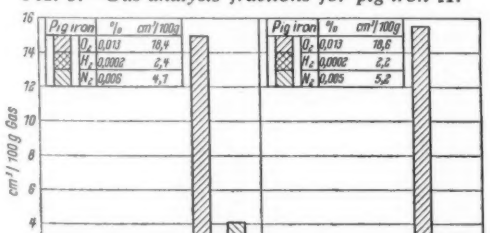
(1) The content of difficult-to-reduce oxides in cast iron is not influenced greatly by the type of material melted in the cupola.

(2) Chill-cast samples contain substantially higher oxygen contents in the form of easily-reduced oxides than do sand-cast samples.

(3) The relatively short time of solidification of a metal-mould sample results in a substantially greater reduction and release of CO formed.

The gas content of the mould samples decreased from the seventh day onwards, when rust-free scrap was charged, and reached values similar to those of the sand-cast samples on the tenth day. When examining the results obtained from the tenth to the thirteenth day, it may be seen that the lower manganese content was not even sufficient to neutralize the sulphur, and that the time from tapping to casting was sufficient to reduce the manganese-poor oxides almost completely. Casts containing high oxygen contents showed that the reaction of the oxides with carbon was violent even during and after solidification—the more violent, the higher the iron content of the oxides. It is seen therefore that a high FeO content of an incompletely refined melt will result in the formation of gases during and after solidification and consequently to porosity and intercrystalline stresses due to agglomeration of gas.

FIG. 3.—*Gas-analysis fractions for pig-iron A.*



Pig-iron Analyses

The behaviour of oxygen in pig-iron can be determined by gas analysis. For example, the oxygen contents of pig-iron solidified in runners, determined by the vacuum-fusion technique, lie between 0.001 and 0.1 per cent., corresponding to 1.4 to 140 ml. CO at N.T.P. in 100 gm. iron. The oxygen must therefore have been taken up after tapping. Table IV gives oxygen contents of pig-iron (runner and chill-cast samples). Again, the table shows that the oxygen was taken up from the air or the sand, involving oxide formation and pick-up by the liquid or partly liquid melt. The great variation in oxygen content in the pig-iron runner is therefore explained. The pick-up of great amounts of oxygen during the remelting of the iron is only possible when the oxygen (which is introduced by large amounts of rust, or oxidizing blast) cannot all react with the carbon. When remelting is carried out under "ideal" conditions, the possibility is given for reduction and slagging of the suspended oxides. The rotary furnace was found most successful, as

TABLE II.—*Gas Content of Grey Cast Iron.*

No.	Gas.	Manner reported.	Ladle sample.	Sand-moulded sample.
1 ..	O_2	Per cent.	0.0017	0.024
	H_2	Ml. per 100 gm. ..	0.24	0.91
	N_2	Per cent.	0.004	0.006
2 ..	O_2	Per cent.	0.0027	0.030
	H_2	Ml. per 100 gm. ..	—	0.25
	N_2	Per cent.	0.003	0.007
3 ..	O_2	Per cent.	0.0018	0.012
	H_2	Ml. per 100 gm. ..	1.2	1.5
	N_2	Per cent.	0.004	0.006

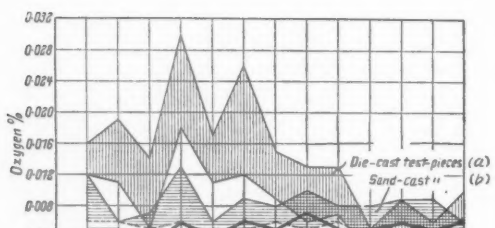


FIG. 4.—*Oxygen content of malleable material, as-cast.*

The areas show the highest and lowest values of the total oxygen content of (a) chill-cast and (b) sand-cast samples. In the lower portion (c) gives the mean value of the difficult-to-reduce oxygen in the sand-cast samples.

shown by J. Willems and co-workers,[3] in which 82 per cent. of the total oxygen content of the pig-iron could be eliminated. The cupola will also give a clean cast iron (see Fig. 1) when clean scrap is charged; the contrary will be the case when the scrap is heavily rusted (see Fig. 2).

Holding in the Ladle

The FeO can also be reduced by silicon by leaving the cupola iron in the ladle for a little time. A number of samples were taken from a ladle of iron at different intervals, and the oxygen content determined by the hot-extraction method (at 920 and 1,600 deg. C.). The results are given in Fig. 5. The easily-reacting oxygen decreased markedly when the ladle was left stationary for 14 min., but at the same time the oxygen of the poorly reacting oxides increased steeply (extraction at 1,600 deg. C.). The latter increase in difficult-to-reduce oxides may be due to the movement of the silicates to the upper part of the melt during standing and from which the samples were taken. As hypo-eutectic alloys are nowadays used for malleable and grey iron castings, a reaction of the metal oxides with the carbon will still occur in the range of solidification. The solidification will begin with the precipitation of pure carbon-poor crystalline solid-solution, while the carbon and metal oxide concentration increases in the remainder of the melt.

The manganese : sulphur ratio will be affected badly by the presence of iron rust in the charge, as theoretically a 1.72-fold amount of manganese is necessary for MnS formation. The heat of formation of MnO is twice that of MnS; therefore MnO will be formed in the presence of oxygen and not MnS. Any MnS present will be reduced by the FeO to form MnO and FeS. MnS melts at 1,620 deg. C., FeS at 1,183 deg. C., and the eutectic FeS/FeO at 940 deg. C. As the amount of manganese was not sufficient to counteract all the sulphur, the formula (Faust) $Mn = 1.7 \times S + 0.2$ should be applied. As seen from Fig. 4, on eight days out of thirteen the Mn was deficient and part of the sulphur was still bound to iron as FeS. Apart from four days on which Mn-poor pig-iron (B) was charged, the Mn : S ratio was only unfavourable on days when heavily-rusted scrap was charged.

Conclusions

The following conclusions can now be drawn.

(a) *Hydrogen.*—The hydrogen content of the sand-cast samples (mean, 2 ml. per 100 g.) agrees with that published recently.[1] Only the first of those samples cast into chills show values similar to those given for oxygen and nitrogen. The hydrogen present in the charge can be evolved at high temperatures when in the upper part of the cupola. The danger of pick-up by the melt will increase with increase in temperature. Undissociated iron rust present in the steel scrap can be the cause of pick-up of hydrogen by the melt. As the solubility of hydrogen in iron decreases with decreasing temperature, the gas might easily be trapped, giving rise to cavities during solidification.

(b) *Nitrogen.*—Following the results obtained in the fractionating gas-extraction method, it can be assumed that part of the nitrogen in the iron is held as nitride which will dissociate at 900 or 1,000 deg. C. This nitrogen may give rise to the same defects. The other nitrogen is dissociated at higher temperatures. It was found that the low nitrogen content of the pig-iron melted in the cupola did not change markedly. An increase in nitrogen was observed when heavily-rusted steel scrap was charged, which was very high in certain cases.

(c) *Oxides.*—Two types of oxides were determined:—

(1) Glass-clear oxides of silicon and aluminium, which are slow to react at the temperature of the liquid cast iron, and which only react at higher temperature at the desired rate.

(2) Coloured metallic oxides, mostly iron and manganese oxides. As these oxides react quicker, only small amounts were found to be present in the cast iron. An increase occurred with increase in steel scrap covered heavily with rust. These oxides will still react with the carbon at as low a temperature as 600 deg. C. The CO or CO_2 formed cannot escape from the solid mass and will therefore give rise to the formation of cavities or try to find a way out by explosion. The reaction between C and metal oxides will be favoured in hypo-eutectic

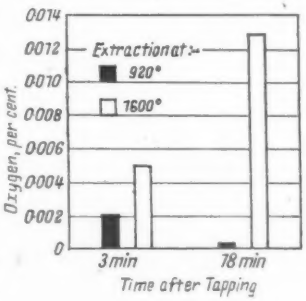


FIG. 5.—*Oxygen in as-cast malleable, with and without holding in the ladle.*

TABLE III.—*Composition of the oxides*

Test.	Per cent. Isolated.	SiO_2	Al_2O_3	MnO	FeO	CaO	MgO	O_2 per cent. Calculated.	Oxygen (per cent.) Fractionated Extraction. 920 deg.	1,600 deg.	Total.
Day 4 ..	0.027	53.0	9.5	1.0	20.8	5.0	1.0	0.011	0.007	0.007	0.014
Day 4 ..	0.029	63.7	8.9	2.0	8.5	5.2	1.5	0.012	0.007	0.007	0.014
Day 7 ..	0.017	51.0	14.0	1.0	2.0	4.5	4.0	0.0064	0.0015	0.0051	0.0066
Day 7 ..	0.0166	55.0	15.0	1.0	2.0	5.5	4.0	0.0066	0.0015	0.0051	0.0066

alloys, where carbon-poor primary crystals are formed and the mother liquor will be enriched with carbon, which in turn will react with the oxides present. Micro-cavity defects may be due to this phenomenon. The start of solidification is about 1,265 which corresponds to a range of solidification of about 120 deg. C. This long solidification range is as much the cause for the defects described as the presence of gases.

Summary

This report should help in reaching a proper understanding on the relationship between gases and oxides in the materials melted, and the resulting failures in the castings. By the application of the analytical processes developed in the field of steel metallurgy to the examination of pig-iron and cast-iron, a far-reaching examination of the quantity, type and occurrence of oxides and gases in these products has been possible. By the isolation of the individual oxide and by the estimation of the quantities of oxygen developed at increasing temperatures, it has been possible to distinguish between innocuous inclusions and those which, because of their easy reducibility, are liable to cause failures in castings—due to the generation of gases.

In the case of malleable-iron castings, which are usually produced with large proportions of steel scrap in the charge, comparatively large quantities of oxide, often of a high-reactive nature, can be found in the final metal. It has been shown that this is very largely due to the use of rusty scrap in the charge. The substitution of clean scrap has resulted in the oxide content of the melted metal being reduced from several hundredths per cent. to only a few thousandths per cent. High gas and oxide contents in cast iron are not caused by poor-quality pig-iron, they are caused by the use of rusty scrap.

The investigation has indicated methods whereby the materials charged into the cupola may be assessed regarding their suitability for the production of sound castings, and, at the same time, ensure that the possible sources of waster castings are as far as possible kept under strict control.

TABLE IV.—*Oxygen Content of Pig-iron (Runner and Chill-cast Samples).*

No.	Per cent. C	Si	Mn	Per cent. O_2 in runner sample. At 900 deg. C.	Total.	Per cent. O_2 in chill-cast sample.
1	3.74	2.59	0.97	<0.0004	0.0055	<0.001
2	3.65	3.25	1.13	0.0006	0.006	0.001
3	4.02	2.72	1.00	0.0006	0.006	0.0015
4	3.64	3.24	1.23	<0.0004	0.004	<0.001
5	3.52	3.34	0.37	0.0007	0.005	0.0015
6	3.44	4.00	0.42	0.0004	0.0025	0.001
7	4.24	0.75	3.87	0.0011	0.011	0.002
8	3.95	2.30	1.07	0.0009	0.005	0.001
9	3.78	0.50	0.36	0.0017	0.0045	0.0025

REFERENCES.

[1] Koch, W., & Bruch, J., *Arch. f.d. Eisenhüttenwesen*, 24 (1953), pp. 457-464. (Mitt Max. Planck Inst. f.d. Eisenforschung 586.)

Janson, J. V., Smith, L. W. L., and Bach, B. B., *J. Res. Dev. Brit. Cast I. Res. Ass.*, 4 (1953), pp. 540-552.

Bach, B. B., *ibid.*, 5 (1953), pp. 45-70.

Bach, B. B., Dawson, J. V., and Smith, L. W. L., *Journ. I.S.I.*, 176 (1954), pp. 257-263.

Bastien, P., Congrès International de Fonderei, Paris, 1953.

Lange, E. A., and Heine, R. W., *Trans. Am. Foun. Soc.*, 61 (1953), pp. 107-130.

[2] "Giesserei," 40 (1953), pp. 516,527.

[3] "Giesserei," 40 (1953), pp. 510-516.

[4] Mitt. Kaiser Wilhelm Inst. f.d. Eisenforschung, 13 (1931), pp. 149-159. Also Dr. Ing. Diss. von Bottenberg, Techn. Hochschule, Aachen.

Publications Received

Driver's Handbook for C-Licence Holders (2nd Edition); by R. E. G. Brown. Published by the Traders' Road Transport Association, Roadway House, 146, New Bond Street, London, W.1; price 1s.

After having sold 70,000 copies of the first edition, a new one was called for, so as to incorporate the new lighting regulations. It is an excellent booklet for firms to distribute to their lorry drivers.

Big Savings with Small Zinc-alloy Die-castings; published by the Zinc Alloy Die Casters' Association, Lincoln House, Turl Street, Oxford.

In this booklet there are over 60 illustrations of small castings, being shown to the same scale as an illustrated threepenny piece. One example which is fascinating is the casting of zip-fasteners direct into the tape. Many other interesting examples are illustrated.

Technical Report—New Series volume II. Published by the British Engine, Boiler and Electrical Insurance Company, Limited, 24, Fennel Street, Manchester, 4.

Unlike the publications of a quarter of a century ago, the Report is almost devoid of cases of breakdown of castings. There is, however, one story recorded of "An Unusual Case of Fatigue Cracking of Bearing Shells." The fracture was due to excessive fluctuating binding stresses that gave rise ultimately to fatigue cracks. Moreover, there were inter-dendritic cavities in the bronze which appreciatively reduced its strength. Of much interest to founders are the three articles on crane slings. They are "Fracture of a Mild Steel Hook," "Brittle Fracture of a Chain Hook Sling" and "A Note on the Use of Chain Slings." In general, the cases of failure reported have been well chosen and are of major interest to the engineering profession.

Book Reviews

The Cupola and Its Operation. 2nd Edition. Published by the American Foundrymen's Society. Available in the United Kingdom from the Penton Publishing Company Limited, 2, Caxton Street, London, S.W.1; price 76s. 9d. post free.

This is the most comprehensive book on the cupola that has ever been published; no aspect has been omitted, and its reliability is guaranteed by the composition of the sponsoring committee. This includes the names of America's acknowledged authorities on the subject.

The scheme for the book has been wisely selected and the ground is covered by four main sections—Operations; Equipment; Materials, and Principles related to Operations. These are sub-divided into 35 chapters and amplified by three appendices.

The section on tuyeres seems to illustrate most types but the one now very popular in France, involving a high wind-belt with piping leading down to twin tuyeres has not been included, yet it is of real practical interest. There is, however, in a later chapter a reference to this system. The modern complications involving hot-blast (of the externally heated and the recuperative type); water-cooling; water-cooled tuyeres and basic linings are adequately dealt with. In dealing with the gun method of patching, some really useful hints are included. It is a pity that this system is restricted in most countries, because the cupolas are too small to permit of effective operation. The section dealing with the important procedure of lighting the bed coke includes consideration not only of gas and oil burners, but also of an electric igniter. As would be expected in a book emanating from America, the chapter on mechanical charging equipment is outstanding and is certainly worth close study. Forehearths and ladles are dealt with in chapter 19, in a well authenticated account. It is noteworthy that all the normal ladles illustrated carry less taper than usual in this country—or none at all. Unless proper counteraction in the matter of design be taken, heavily tapered ladles —through expansion—can cause the seizing-up of the gears. The chapter dealing with atmospheric-humidity control covers matters which have not had a great deal of attention in this country, as variations are not so wide here as in the States, yet the subject must not be discarded as being of no importance.

It is obvious that the Americans have devoted more attention to slag quenching and disposal than the average foundry in this country and some of the methods described and illustrated are worth emulating by the larger concerns. Dealing with slag wool the placing of chains and screens in front of the slag-hole are not mentioned, though a hinged iron sheet is mentioned.

Chapter 24 is very important, as it deals with cupola emissions. Many districts in the U.S.A., are as strict as some local authorities here. Thus it is worth-while to study the steps which have been taken in the States to mitigate the nuisance of cupola effluent. The American apparatus looks rather expensive and this directs thoughts towards the recuperative types of blast-heating plant, which incorporate a gas-cleaning system. The application of water-cooling to both the shell and the tuyeres is considered at some length in chapter 25, and the Metallurgical Blast Cupola is covered in detail. The notes on tramp elements to be found in scrap, when dealing with antimony, warn readers against enamelled components. While enamels recently produced in this country are less likely to contain this element, it is still necessary to be on guard.

The chapter on "Alloys in Cupola Melting" (No. 28), is well balanced, and interesting and authoritative, and includes the latest practice for cerium and magnesium additions. "Fuels for Cupolas" is not so interesting, but as little Beehive coke is available for iron foundries in this country, resort has to be had to available supplies. However, the situation in this country, though nothing like so good as prewar, is still better than in most other countries. Much the same conditions apply to refractories, where local conditions are the governing consideration.

There is some useful information disclosed in Chapter 32 on fluxes and slag control and in the one which follows on "Combustion in the Cupola." These are picked out for special mention because in no case is there any reference to literature emanating from this country, with the solitary exception of the Rambush and Taylor paper. The last chapter covers the metallurgy of cast iron.

The book can be unreservedly recommended as the most exhaustive treatise on cupola practice available in the English language or indeed any other.

V. C. F.

Titanium Oxide in Vitreous Enamels, produced by British Titan Products Company Limited, York (presumably available to interested readers on application to this address).

It is not very long since the compounding of vitreous-enamels was a carefully guarded, hole-in-the-corner affair and the weights of ingredients were kept in locked boxes. Very refreshing, therefore, is the complete candour of this attractively bound 60-page brochure, which gives details of processes and enamel ingredients, using the company's products to prepare frits and finished coatings. Logically, the extraction and preparation of titanium oxide is dealt with first; then comes its incorporation in enamels and frits, accompanied by notes on optimum working details and rounded off by sections on such subjects as dry- and wet-process cast-iron enamels, and specialized uses (including aluminium enamel). Finally, there are three appendices—wherein test methods, oxide compositions, expansion factors, and a dozen typical frit compositions are listed—and a bibliography. British enamelling leads the world for durability and acid resistance and much credit for this state of affairs must be given to such supply companies as the producers of this brochure, who co-operate so fully in supplying data and formulae for the practical enameller.

Estimating for Blacksmiths and Agricultural Engineers. Published by Rural Industries Bureau, 35 Camp Road, Wimbledon, London, S.W.19. Price 3/6.

The object of this book is to eliminate much of the guesswork usually associated with costing by rural craftsmen, despite the fact that many are quite good "guessers." Moreover, the book gives actual examples, using current prices—with a warning that they may change almost overnight—reinforced by tabular matter and clear sketches. Not much is said about "overheads" but attention is drawn to their incidence and to the availability of another book on the subject.

Mechanical World Electrical Year Book, 1955. Published by Emmott & Company, Limited, 31, King Street West, Manchester, 3; price 3s. net.

The section on control gear has been entirely rewritten, but the features which have proved popular in the past have, in general, been retained and in some cases expanded.

Non-ferrous Foundry Fuel*

by R. L. Robinson

Conservation

The subject of fuel efficiency has assumed a growing importance over the past few years, due to the need for fuel conservation in itself and to its increasing cost to the consumer. From detailed plant investigations (carried out by the National Industrial Fuel Efficiency Service engineers) it has been possible, through assessment of plant performance, to indicate the scope for increased efficiency by improved operating technique, instrumentation, modification to design and waste-heat recovery, etc. The value of such recommendations on the present price structure of fuel in terms of financial saving due to reduced fuel consumption or increased production on the same fuel, makes any capital expenditure involved a profitable undertaking.

Scope for Fuel Saving

Due to the high temperatures involved in the melting of copper and brass, the efficiencies of existing furnaces are relatively low and comparatively small increases in efficiency can result in large fuel savings. For example, with a reverberatory-type metal bath of 12.5 per cent. efficiency (refining copper at 1,200 deg. C.) for every 10 tons of fuel burned, the heat from 1.25 tons only is used for melting, the equivalent of 6 to 8 tons go up the stack, and 2 to 3 tons are lost through the walls and roof. An increase of efficiency from 12½ to 15 per cent., would save 17 per cent. on fuel consumption.

The fact that such plant may continue to give the required production in spite of the high inefficiency and even in face of an increasing inefficiency due to deterioration, tends to mask the value of simple remedies, if, in fact, such remedies are fully understood. Frequently, at say little or no capital cost, remedies can be applied to cure faults otherwise attributed to other sources of production difficulties.

Factors Affecting Efficiency

The most important factor affecting fuel efficiency is furnace design. In considering design, the following must be taken into account; production requirements upon which the size must be based—too large or too small can only lead to inefficiency; type of fuel to be used; and the efficiency of heat transfer to stock. The combustion space should be just sufficient to complete combustion and the furnace should be well constructed, well insulated and easy to control. Consideration should be given to the possibilities of continuous operation and of waste-heat recovery.

Rotary furnaces appear to have advantages over reverberatory types due to the better heat transfer and the protection of refractories resulting in fuel savings of the order of 25 per cent.

Choice

Choice of fuel depends on availability, quality, ease of control, cost, suitability to the process and working conditions. A word of warning should be given against too hasty a decision to convert from one type of fuel to another. Before doing so, it should be ascertained that comparable results cannot be obtained by simple methods of increasing efficiency with the existing fuel. Conversion without alteration in furnace design often causes great disappointment.

Gaseous and liquid fuels can easily be controlled to give maximum combustion efficiency and the desired heat input. The latter gives high temperature, luminous flames which are very effective in melting furnaces. Coal or coke, however, used directly or through gas producers are cheaper. Low-frequency electric furnaces are very efficient, but the coal equivalent at the electric power station is high in relationship to other forms of heating.

Combustion Equipment

In selecting combustion equipment due regard must be paid to the maximum duty required. In general, equipment working below its rating is working inefficiently. Simple controls should be provided for the correct proportioning of air and fuel and where possible, automatic control should be considered. In many instances, reduction of grate area (or of the number or size of burners) has resulted in increased flexibility and more economic production. It is emphasized that, in both furnace design and the selection of combustion equipment, the advice of the specialist can prove invaluable.

Maintenance and Operation

Regular maintenance of high-temperature plant is of the utmost importance. Deterioration of brickwork, particularly of hot-face linings, doors and door frames, results in high air in-leakage, and short-circuiting. In the case of oil- and gas-fired furnaces, optimum operational control can only be achieved if burners are well maintained.

To prevent high fuel costs, it is necessary to have the knowledge and the means to check whether the fuel used is being burnt efficiently. On an oil-fired furnace, fuel consumption may be reduced by 30 per cent. when excess air is reduced from 50 to 25 per cent. of the air theoretically required. With proper control of air : fuel ratio, heating-up time is reduced, higher flame temperature is attained and an overall saving in fuel is made.

On a furnace where a reducing atmosphere is necessary, care should be taken to keep CO content to a minimum, an increase from 1 to 2 per cent. CO increases fuel cost by 5 per cent. Considerable fuel savings can be made by close control of combustion. A periodic check or continuous records of CO_2 in stack gases and stack draught should be

* Address given before London-area members of the Association of Bronze and Brass Founders. The Author is on the staff of the National Industrial Fuel Efficiency Service.

kept and appropriate adjustments made. All this adds up to increased production and lower fuel costs which should be the aim of every foundry.

Load Recuperation and Waste-heat Recovery

Exit gases from furnaces, with temperatures of 1,000 and 1,300 deg. C contain ⅔ to ¾ of heat supplied to the furnace. Much of this heat can be recovered by load recuperation or by preheating the air for combustion. In the former, preheating the incoming furnace charge should be incorporated where new furnaces are installed or modification to existing furnaces is being made. Preheating of combustion air by recuperators and regenerators reduces fuel consumption, speeds up combustion and increases flame temperature, which is important in quick metal melting. By preheating the air to 535 deg. C (1,000 deg. F) on a continuously-operated 20-ton copper-refining reverberatory furnace, the fuel saving is in the region of 20 to 25 per cent. or 300 to 400 tons of coal per annum.

Recovery for External Use

Another form of waste-heat recovery is by the introduction of waste-heat boilers. These boilers can be installed to extract the heat from the waste gases in the form of steam or hot water for use elsewhere in the works. In one case, the waste heat from a 75-ton steel furnace, after preheating the producer gas and combustion air in a recuperator, was passed through a waste-heat boiler thereby generating 8,000 lb. steam per hour, saving ½ ton of coal per hour previously used for this purpose.

X-ray Penetration of Steel

Experiments in the Two to Six-million Volt Range

An investigation into the hitherto unexplored X-ray region of from two to six million volts, still dominated by the Compton absorption process, was recently carried out in the U.S.A. by C. H. Goldie and others with a view to ascertaining possible advantages in radiographic speed, sensitivity, and latitude for the examination of heavy metal sections, the results being recorded in a paper entitled "Radiographic Properties of X-rays in the Two- to Six-million Volt Range," published in "A.S.T.M. Bulletin" (October). The study, it is stated, was supported by the United States Office of Ordnance Research and was facilitated by the availability of both a 3-million-volt Van de Graaff X-ray source and the Office of Naval Research Van de Graaff accelerator which covered the 4- to 5-million-volt X-ray range.

Absorption and Scattering

The dominant absorption mechanism in the lower million-volt X-ray range by which photons are diminished in energy and scattered, is known as the Compton effect. In these interactions, dependent primarily on electron density, the photon collides with and imparts energy to an atomic electron, and then proceeds in an altered direction with correspondingly diminished energy. These modified photons are the principal source of scattered radiation. In this energy range, the pair-production mechanism of X-ray absorption in steel is a lesser factor. In this process, the photon energy is converted into the rest mass of two electrons which carry away the remainder of the incident photon energy. Pair-production first appears at 1.02 million volts, the rest energy of two electrons, and thereafter increases with photon energy and the atomic number of the absorber. For 6-million-volt photons, for example, pair-production process in iron causes about half as much absorption as the Compton process, while in lead, pair-production absorption is about 50 per cent. greater than Compton absorption for this energy. The positive electron produced in this process disappears at the end of its path by combining with an atomic electron somewhere in the absorber, usually with the emission of two photons of 0.5 million volts energy. This annihilation radiation is another source of scattered radiation in the high-energy region. The photo-electric process, which is the principal absorption mechanism for X-rays below 100 kv., particularly with heavy metals, is negligible in the million-volt region.

The direct, or picture-bearing, radiation emerging from an absorber is that portion of the incident radiation still travelling in the original direction. It is the radiation which would emerge if all interactions were complete absorption processes. Unfortunately, the scattered radiation produced within the absorber contributes greatly to the emerging radiation, but serves only to fog the film. The total transmitted beam is the sum of this direct and scattered radiation. The investigation confirmed experimentally the expected large increase in radiographic speed accompanied by a progressively smaller improvement in sensitivity as the voltage is increased from 2 to 6 million volts.

Assuming 1 hr. as a practical maximum exposure under the conditions of test indicated by the authors, the maximum steel thickness penetrated was found to be 9.5 in. for 2-million-volt X-rays, 13 in. for 3 million volts, and 20 in. for 6 million volts. These figures are increased somewhat by the use of faster film and shorter target-to-film distance. An idea of the gain in speed with voltage is indicated by the fact that the 20 min. required for 7 in. of steel at 2 million volts would be reduced to 2.5 min. at 3 million volts, 14 sec. at 5 million volts, and 5.5 sec. at 6 million volts.

MR. W. JENKINS GIBSON, financial director of Hadfields, Limited, steel manufacturers, Tinsley, Sheffield, flew to Lisbon on December 6 on a business trip.

NICHOLL & WOOD, chaplet manufacturers, will shortly be opening an extension to their premises at Dunkirk Lane, Halifax, which will almost double their present floor space and will facilitate increased production.

Sampling for Carbon Determination in Cast Iron

When making castings for machine-tools it is important to control the carbon content and for this purpose it is essential for the sample taken to be truly representative of the whole material, a requirement very difficult to attain in practice. Mr. Wm. Y. Buchanan in his paper "Cupola Melting of Cast-iron Borings and Steel Turnings"* outlines a method found to be successful as follows:—

Fireclay Funnel Used

The method standardized uses a small fireclay funnel with an orifice ¼-in. dia. The metal is blown into a copper vessel about 15-in. diameter containing a little water and wet surfaces (Fig. 1). This gives a sample instantly ready for use and one much more representative than any form of drillings. The well-known errors of the carbon estimation due to the pulverizing of the graphite during drilling and concentration in the fines of the sample are eliminated.

In the manufacture of machine-tools, the key to quality of cast iron is in the control of carbon, *i.e.*, the quantity, particularly the quantity of free graphite, together with the size and formation of the flakes. Repeated analysis on the same sample of pig-iron got by drilling resulted in the following figures for the percentage of total carbon: 3.43, 3.41, 3.37, 3.49, 3.45, and 3.40, with an average of 3.42. There are no reliable "standard cast irons" on the market and suppliers have always turned a deaf ear to requests for carbon standards. It is therefore a difficult and tedious process for a foundry metallurgist to check his apparatus at any time and much unsatisfactory duplication goes on.

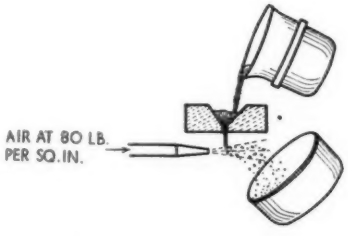


FIG. 1.—*Sampling device for providing small shot which give uniformity of results in carbon determinations on cast iron.*

The unreliability of the results is due to the fact that, while boring a sample, the graphite is pulverized and may be lost to a varying degree in the sampling and again at the weighing-out stage. When the above sample is graded on sieves, the variation in results is considerable, as shown:—

	Total carbon (per cent.)
On sample remaining on 22 mesh	3.54
" " " " 44 mesh	3.40
" " " " 72 mesh	3.27
" " " " 100 mesh	2.88
Sample passing through 100 mesh	3.99
Average	3.42

It is thus impossible to take a small quantity which will be so blended as to give a representative average composition. Segregation of carbon was clearly demonstrated many years ago and elaborate patterns of hole boring have been used to get a representative sample from even a sand-cast pig.

The pellet method is the obvious answer to these problems, since it can be applied to liquid metal in the foundry. Its advantages are that the pellets are ready almost instantly for use (instead of boring the sample the next day) and of course all further preparation is unnecessary. There appears to be no oxidation of cast iron whatever during granulation, and there is no need for special inert gas atmosphere as may be desired in the case of the sampling of mild steel.

Repeat analyses carried out on a drilled sample of cast iron gave the following successive percentage of total carbon: 3.00, 3.01, 3.07, 3.10, and 3.16, giving an average of 3.07. The same metal sampled in the form of pellets gave 3.19, 3.19, and 3.19. Thus, the drilling method is shown to give low results and the difference in successive tests is due to the fact that the larger chips of cast iron are inclined to be lifted first. As the sample is used, the proportion of fines increases and the percentage of carbon increases.

When iron is run from the furnace white or near white, it is impossible to drill and the casting of very heavy samples even up to 7-in. square sections does not make for any improvement. At such times the pellet method becomes indispensable.

* Official exchange paper from the Institute of British Foundrymen to the 1954 Convention of the American Foundrymen's Society.

Making Cupola Tapholes with a Template

Length of the taphole.—Happenings taking place in a tap hole bear no relation to its dimensions or its construction. Obviously the cardinal condition is to prevent iron solidifying in the hole, but this is more a question of hot melting, yet the length of the tap hole is not unimportant. It should not be overdone, especially where the hourly production is low or where tappings are infrequent. For small cupolas (output less than 6 tons per hour) a satisfactory method consists in making the length of the cylindrical part of the tap hole equal to its diameter.

Diameter.—With discontinuous casting. there is no fixed rule which determines to any real extent the diameter of the taphole. Nevertheless, it is thought that (1) a diameter of ⅜ in. is the practical minimum below which one should not go; (2) a diameter of ¾ in. is suitable for rapidly filling 25 to 50 lb. shanks; a diameter of 1¼ in. is useful to filling large ladles (a ton or more).

Taphole flares.—The main purpose of the two widened openings usually associated with both ends of the taphole is to provide a convenient length for giving a maximum of solidity to the refractory in the essential part.

Blast Furnaces for India

Worth nearly £3,000,000, a contract for two large blast furnaces has been placed by the Indian Iron & Steel Company, Limited, with Ashmore, Benson, Pease & Company, Stockton-on-Tees. The furnaces, to be built at Burnpur, India, will have hearths of 25 ft. dia. and each will be capable of an output of 1,200 tons of iron a day. The first furnace will go into production in 1958 and the second a year later. The contract has been awarded in the face of competition from the Continent and the United States.

Atomic Energy Challenge

When Mr. Ritchie Calder told the Coal Industry Society on December 6 that in 10 years' time his name would be a household word, he was referring to the fact that within a decade Calder Hall, the atomic station in Cumberland, would be feeding electricity into the national grid from generators driven by steam converted by the heat of gases from atomic reactors. In fact, 1958 was a conservative estimate of this transformation.

It was estimated, went on Mr. Calder, who is science editor of the *News Chronicle*, that by 1960 the needs of the electricity industry would be 13,000,000 tons more coal than the pits could supply and this figure would grow to 63,000,000 tons a decade later. Atomic energy as a fuel, with the atomic pile as a furnace, must provide the solution. Power from hydro-electric schemes was insufficient and greater imports of oil were not the answer. Work was going on experimentally with the breeder pile, which would produce more fuel than it burnt up in producing power. There was the challenge to coal as a fuel for power, although it would still be needed for carbonization and its chemicals. Mr. Calder ventured that its future lay as a source of wealth in its conversion within the chemical industry.

In Britain much depended on this prototype for converting atomic energy to peaceful use. Mr. Calder thought that here was a challenge to the export trade in that there was a great potential for atomic stations in under-developed lands. It would be possible to set up an industrial oasis in the Sahara. Once established there would not be necessary the long lines of communication to supply conventional fuel to the stations. He reminded the Society that 1 lb. of uranium, which was about the size of a matchbox in volume, was equivalent in potential power to 150 10-ton trucks of coal.

Flying Executives

That time is money is a modern maxim, which, apparently, has not appealed to industrialists in Europe when it comes to buying their own aircraft to fly their executives on urgent business. Rear-Admiral M. S. Slattery, chairman and managing director of Short Bros. & Harland, Limited, the Belfast aircraft manufacturers, believes that commercial organizations are not willing to accept the responsibility of owning and operating their own aircraft, although they realize how much time can be saved.

Under a new scheme, therefore, his company is prepared to undertake all the work involved, advise on the type of aircraft best suited to an organization's need, and will arrange for the purchase of the plane. Payment would be made in an annual fee to the company, which would include the capital cost of the aircraft, over a number of years.

The company estimates that if a miniature airliner, costing about £30,000, was decided upon, the annual cost of its service would total £16,000, inclusive, for 300 hours' flying. For 500 hours' flying the cost would be £19,500, while it would be £36,000 for 15,000 hours.

BRUSH ELECTRICAL ENGINEERING COMPANY, LIMITED—Mr. J. W. C. Milligan has relinquished his position as managing director and Mr. M. Tattersfield, his deputy, will assume responsibility for the management as a director and general manager.

Too Few Apprentices

The difficulty of securing apprentices for the ironworking trades was referred to by Capt. J. E. Sissmore, personnel manager of Vickers' Armstrongs, Limited, Walker-on-Tyne, at the annual apprentices' prizegiving. Reporting that the company now employed 360 apprentices and boys, against 350 a year ago and 250 in 1951, Capt. Sissmore said that the requirements of the firm had been met without any serious difficulty, except in the ironworking trades. Although there was some sign of improvement there, the situation still gave cause for grave concern. This year Vickers-Armstrongs had nearly reached its intake target of 10 platers and 20 welders, but had been unsuccessful in obtaining any caulkers or drillers. Moreover, riveters had been conspicuous by their absence for years.

Capt. Sissmore thought that schoolmasters, youth employment officers, and parents were the people who most of all could get boys to come forward for the iron trades. It was natural for boys to want to become wage-earners, but parents should point out the lasting benefits of serving an apprenticeship, even in the iron trades, where wages were high, and where, because of modern developments, there were always jobs available outside the shipbuilding industry.

Problems of the Shipyards

The British Parliamentary Mission to Japan has been assured by Japanese shipbuilding representatives that the Japanese Government's policy of subsidizing shipbuilding and paying part interest on shipbuilding loans are only temporary measures. They were intended, it was stated, to provide for the rebuilding of the Japanese merchant fleet to its pre-war size, and would not be continued indefinitely. The goal was of a merchant fleet of 4,000,000 tons gross by the end of 1958; after that there would be no further expansion. The payment of part interest on shipbuilding loans was to compensate Japanese shipping companies for their wartime losses.

Meanwhile, the news from the shipyards at home is rather disappointing, more orders having been cancelled and lower tonnages produced in some quarters this year. Recently, it was revealed that contracts placed with British concerns for four tankers of 32,000 tons dw. each were cancelled some months ago. Two of the tankers were on order from John Brown & Company (Clydebank), Limited, and two from Vickers-Armstrongs, Limited, Walker-on-Tyne, for the Alvion Steamship Company, Panama. Their value is estimated at between £7,000,000 and £7,500,000.

There were hopes a few months ago that the launching output of Tyne shipyards (excluding Blyth) would exceed the post-war record set up in 1951, but four launches scheduled to take place this year have been postponed until next year, so that the total tonnage produced this year will probably amount to about 200,000 tons. Other yards also record lower outputs this year.

Competition from German shipyards may be expected to increase steadily in the future. It has been reported that the Blue Star Line has ordered a second refrigerated cargo liner from the German shipyard, Bremer Vulkan, of Bremen-Vegesack, and is considering contracting for a third. The vessels are believed to cost about £1,250,000 each.

MONSANTO CHEMICALS, LIMITED—Mr. J. W. Urban, director of oversea relations, has been appointed a director. Dr. W. D. Scott has resigned from the board.

Die-casting of Aluminium Alloys

By Thomas A. Dickinson

Aluminium castings with tolerances ranging from plus-minus 0.010 in. to zero are being produced as gravity-die-castings, in permanent moulds without a substantial number of rejects by Pacific Cast Products of Alhambra, California. Moulds used by the company are made of Meehanite metal—which has been widely used in the manufacture of engineering component parts. Other founders use the same metal in fabricating dies for die-casting, although few have enjoyed enough success in this connection to abandon the use of conventional alloyed iron.

According to Pacific Cast Products' officials, properly-designed Meehanite dies can be fabricated with enough economy to be desirable substitutes for expensive steels when producing as few as 200 to 500 castings (depending on the need for products of superior quality). Yet, some of the company's dies have been used to produce 500,000 castings each before they were worn or damaged enough to be relegated for salvage.

Aluminium articles that have been successfully cast in these dies ranged from small fittings and instrument components (Fig. 1) to large housings and cylinder heads (Fig. 2), in weight from two ounces to eight pounds, and they comprised virtually all castable types of aluminium—although the company specializes in the use of Alcoa 356 alloys.

Die Design

In so far as is practical, the die components are designed so that they can be machined from Meehanite stock materials with equal thicknesses in each circumstance because dies with widely-varying wall-dimensions could not be heated or cooled in a manner that is essential to the production of precision castings.

Particular care is taken in gating the dies to avoid uneven configurations and projections which might cause turbulence in the molten alloys to be cast therein, since turbulence is one of the main causes of defects, such as extreme porosity in gravity-die-castings. However, since it is not always possible to predict sources of turbulence, gating allowances are such that any given die can be re-worked if practical experience shows that it is producing defective castings, due to mistakes which were made in designing or fabricating the tool.

Generous fillets and blends are incorporated in all of the company's gravity-die designs not only to minimize the possibility of shrinkage and cracking, but to equalize the distribution of the service loads that will be applied to finished castings.

Cores and Inserts

Where cores are essential to the production of castings provisions are usually made for the incorporation of dry-sand cores in the Meehanite cavities. Such cores are usually purchased from specialized subcontractors, since Pacific Cast Products do not use them in sufficient quantities to justify an investment in efficient coremaking equipment.

Further provisions have been made for the incorporation of inserts such as tubes, bushings, and threaded parts in the mould cavities. The most common inserts for aluminium castings are made of iron and steel. However, copper and brass inserts have been satisfactorily employed where it was possible to prevent their solution in the molten aluminium.

The components forming the main cavity are hinge-assembled, so that they can be opened and closed with maximum efficiency by the one operator, assigned to each production tool. Moulds needed for production at any given time are moved to positions near the furnaces where aluminium is melted before they are used in order to avoid excessive heat losses in the process of transporting molten metal by ladle into the mould cavities.

FIG. 1.—*Removing one of the smaller gravity-die-castings from its mould. A simple cam-action is used to open and close the dies.*

FIG. 2.—*Large gravity-die-casting, made by Pacific Cast Products, as well as the Meehanite die from which it was made; note the hinged, sectional construction.*

Procedures

To prevent defects due to the rapid chilling of cast aluminium, moulds in current production are torch-heated to temperatures of about 260 or 315 deg. C., prior to the beginning of each work period. No additional heating is normally required during a working period, because the preheating temperatures are usually maintained by the aluminium cast into the dies. Three Knapp furnaces, each having a capacity of 500 lb., are used by this concern in the process of manufacturing as many as 6,000 castings per day.

The time required to solidify an aluminium casting in a Meehanite die is, of course, variable—depending on the size of the mould, the quantity and pouring temperature of the alloy, etc. However, most dies can be opened within two to five minutes after casting. Following unloading operations, the castings are "de-flashed" and otherwise machine finished in the usual manner. Rejects in most cases total less than 1 per cent. of all castings produced. Aluminium castings are now being produced in 300 Meehanite dies in current use at this firm, which have an estimated value of about £130,000.

Place for Skilled Work

Although the company makes use of virtually all modern quality-control devices now applicable, the proprietors, W. D. McCave and A. J. Armant, maintain that there is still no substitute for skilled and intelligent employees in foundrywork. This is because foundrywork in general cannot be foolproofed. Pyrometers are excellent when in good order, but much damage can be done if they fail to function properly and employees are unable to look into a furnace and tell whether the materials are being properly melted.

As to dies, the management of this concern believes they use the best that can be made for their type of work, yet any die is likely to develop defects, so that it can be imagined what might happen if the workers could not tell whether they were serving their purpose properly.

Pre-melting of Electric-furnace Charges*

At Samuel Fox & Company, a branch of the United Steel Companies, Limited, attention has been paid to the development of an idea, which emanated from the manager of the electric steel plant, whereby the charge of an electric-arc furnace would be pre-heated or pre-melted under an oil-fired hood after being placed in the body of the furnace, the body being transferred in due course to its normal position under the electrodes for completion of the heat. By this means, it was suggested, not only would the cost of electricity and electrodes per ton of steel be reduced to one-third, but also it would mean that if oil pre-melting were established as a regular practice the electrical equipment normally provided for a 10-ton cold-melt furnace would be capable of refining a 30-ton charge.

The United Steel Companies research department had for some time been giving thought to intense combustion and the possibility of burning much larger quantities of oil per unit of combustion space, so that when the premelter idea was suggested it aroused considerable interest and enthusiasm. First, the shape of the combustion space had to be considered and the expected flow pattern arising from various arrangements of burners and exit flues determined. The next stage was to build a 1/5th scale "hot" model to determine whether ferrous metal could, in fact, be brought to melting temperature. This led to special consideration of burners and with some initial help from Joseph Lucas, Limited, a burner, based on the principles of the jet engine combustion chamber, was evolved which gave a phenomenal heat release. From this, thanks to the courage of the Fox management, work increased to full scale and a pre-melting hood was designed which has now been installed in the electric steel plant at Stocksbridge in conjunction with a 12-ton arc furnace This unit embodies six of the special burners, which are called "jet-cans," each capable of burning 40 gall. of oil per hour, preheated air being supplied from a recuperator installed in the waste gas system. Oil can be burnt under stoichiometric conditions to provide 82,000 B.Th.Us. per hr. per cub. ft. of furnace volume, which is eight times the equivalent rate of heat release in an average open hearth furnace.

In trials of this pilot plant, oil has been burnt for prolonged periods at the rate of 200/240 gall. per hr. and the practicability of melting by the method has been established. Whether the economics of the operation prove to be attractive or not remains to be seen.

* Abstracted from an address by F. H. Saniter to the Sheffield Metallurgical Association on "Recent Research Projects in the Iron and Steel Industry."

Air Pollution Report

"*Clean-air Act*" *Recommended*

It is felt that there is such a heavy portent for the foundry industry, if the (Beaver) report of the committee on air pollution is made law, that the main provisions of the report should be widely known. Appointed in July of last year, the terms of reference of the committee, over which Sir Hugh Beaver presided, were "to examine the nature, causes and effects of air pollution and the efficacy of present preventive measures; to consider what further preventive measures are practicable; and to make recommendations." Implementation of the committee's recommendations will require legislation by the Government and in the domestic sphere relies largely on a substantial increase in the production of smokeless solid fuels and appliances to use them.

The accompanying table shows the main uses of fuel and estimates of pollutants discharged from such uses in Great Britain in 1953. The committee's main findings may be briefly summarized as follow:—

1. The effects of the pollution which arises from the combustion of coal, oil and their products are most severe, and the need for prevention is most urgent in the "black areas," *i.e.*, the urban areas which are liable both to heavy pollution and to natural fog;

2. A distinction can be drawn between visible pollution by smoke, grit, and dust, and pollution by invisible gases, the most important of which are the oxides of sulphur;

3. More than half of all the smoke comes from industrial sources and railways, but for each ton of coal burnt domestic chimneys produce twice as much smoke as industry and discharge it at a lower level;

4. Nearly all the grit and dust comes from industrial sources, including power stations and railways;

5. Sulphur dioxide is discharged wherever coal, coke, or oil is burnt, whether in industrial or domestic premises.

The committee states its emphatic belief that air pollution on the scale familiar in this country to-day is a social and economic evil which should no longer be tolerated, and that it needs to be combated with the same conviction and energy as were applied 100 years ago in securing pure water. Given the will it can be prevented. But the problem is not one which can be solved overnight. Real improvement can be secured only by a continuous programme urgently and insistently carried out over a number of years. The objective of the committee's recommendations is that by the end of 10 to 15 years the total smoke in all heavily populated areas would be reduced by something of the order of 80 per cent. This would mean a degree of freedom from air pollution which many parts of the country have not known for more than a century.

It is basic to all recommendations that at the outset it should be made the declared national policy to secure clean air, and that a statement to this effect should find expression in the new legislation —the "Clean-air Act"—which the committee is recommending.

TABLE I.—*Main Supplies and Uses of Fuels and Estimates of Pollutants Discharged in* 1953.

Class of consumer.	Fuel supplied.	Fuel burned.			Pollutants discharged.		
		Solid.	Liquid.	Coke-oven gas (unpurified).	Smoke.	Grit and dust.‡	Sulphur dioxide.
	Million tons.	Million tons.	Million tons.	Million cu. ft.	Million tons.	Million tons.	Million tons.
Coal—							
Domestic	36.8	36.8	—	—	0.9	0.1	0.9
Electricity works	†36.7	36.7	—	—	Small	0.3	1.0
Railways	13.8	13.8	—	—	0.3	0.1	0.4
Industrial and miscellaneous*	64.6	64.6	—	73,976	0.8	0.3	1.8
Coke ovens†	25.9	—	—	128,040	Small	Small	0.1
Gasworks†	27.2	6.2§	—	—	Small	Small	0.2
	205.0						
Coke—							
(Excluding consumption in gasworks and blast furnaces)	—	14.7	—	—	Nil	Small	0.4
Oil—							
Diesel and gas oil	3.0	—	3.0	—	—	Nil	0.1
Fuel oil	5.3	—	5.3	—	—	Nil	0.3
Creosote-pitch mixture	0.7	—	0.7	—	—	Nil	Small
	9.0						
Total	—	172.8	9.0	202,016	2.0	0.8	5.2

* Includes general industry, collieries, patent-fuel works, non-industrial establishments, waterworks, and the Service Departments.
† Although over the whole country the smoke and grit discharged from gasworks and coke ovens is small, the pollution from certain types of plant and particularly from older coke-oven plants can have a serious local concentration.
‡ This column does not include grit and dust emissions, estimated as about 0.5 million tons, from industrial processes other than steam raising.
§ This is coke.

Air Pollution Report

Summary of Recommendations

The following is a summary of the committee's recommendations entailing legislation:—

(1) Subject to certain exceptions the emission of dark smoke from any chimney should be prohibited by law.

(2) *The use of efficient grit and dust-arresting plant should be obligatory in new industrial installations which burn pulverized fuel, or solid fuel in any form at a maximum rate of* 10 *tons an hour or more. It should be the duty of the owner or occupier of premises on which any such installation, new or existing, is situated, to take measurements of grit emission and to inform the local authority of the results if so required. In other industrial installations fired by solid fuel, all reasonably practicable steps should be taken to prevent the emission of grit and dust.**

(3) In the case of certain industrial processes in which the prevention of dark smoke, grit, or harmful gases presents special technical difficulties, responsibility for ensuring that the best practicable means of prevention are used at all times should be vested in the Alkali Inspectorate, and the provisions of the Alkali Acts should be extended accordingly.

(4) The provisions now in force under a number of local Acts for regulating the design of new industrial furnaces should be included in general legislation.

(5) The law for the control of smoke from railways, and of pollution from colliery spoilbanks, should be brought up-to-date and strengthened. Responsibility for enforcement should rest with the local authorities.

(6) Local authorities should have power under general legislation by means of Orders requiring confirmation by the appropriate Ministers to establish (*i*) smokeless zones in which the emission of smoke from chimneys would be entirely prohibited; and (*ii*) smoke control areas in which the use of bituminous coal for domestic purposes would be restricted.

(7) Financial assistance should be provided by local authorities and by the Exchequer towards the costs incurred by house owners in converting appliances in smokeless zones and smoke control areas.

(8) Domestic heating appliances installed in all new premises should be of approved types.

(9) The present purchase tax of 50 per cent. on gas and electric room and water heaters should be removed.

(10) Except for the processes referred to in (3) above, responsibility for enforcing the law for the prevention of smoke and grit should be placed as a statutory duty on local authorities.

(11) Local authorities should be required to submit annual reports on their progress in smoke abatement to the appropriate Minister.

(12) Penalties for smoke offences should be increased.

Other Recommendations

The committee also recommends that codes of practice indicating the extent to which smoke can be reduced with good practice, and the means of securing such reductions, together with standard specifications for smoke indicators, recorders, and alarms should be prepared and issued by the British Standards Institution, which in addition should consider devising simpler standard methods of sampling flue gases to determine grit emissions.

Stoking should be recognized as an operation requiring skill, and firemen should be properly trained and remunerated. The Government Loan Scheme for approved fuel-saving equipment in industry should be extended to include equipment installed for the purpose of reducing air pollution, and consideration should be given to allowing the whole of the capital cost of new plant and equipment installed to save fuel and to prevent smoke to be charged against revenue for tax purposes in the year in which the expenditure is incurred.

The most efficient practicable methods of removing sulphur from flue gases should be adopted at all new power stations in or near populated areas.

The factor of pollution should be taken into account when future schemes for the electrification of the railways are being considered and the programme of electrification should be accelerated and extended. The changeover from steam to Diesel shunting locomotives should be accelerated.

The committee is of the opinion that the present law for the control of pollution by motor vehicles should be more rigorously enforced.

The prevention of domestic smoke will require the replacement of bituminous coal now used in domestic premises in the "black areas" by smokeless fuels, and also the provision of new appliances, fitted with easy means of ignition, in which such fuels can be burnt satisfactorily. This should be secured by the progressive extension of smokeless zones and smoke control areas as increased supplies of smokeless fuels are made available.

The British Standards Institution should prepare specifications and methods of testing coke for household use and for domestic solid fuel appliances.

Clean air should be the declared national policy and it should be recognized both by the Government and the nationalized fuel industries as an essential element in fuel policy in the future.

Local authorities should employ adequate smoke-control staffs with the proper training and technical qualifications. Arrangements should be made to secure effective co-ordination as between local authorities in the black areas and especially in Greater London.

Development and research work on the many technical problems now outstanding should be undertaken or accelerated.

Finally, the committee recommends that a "Clean Air Council" should be established to co-ordinate and encourage research work and to review the progress made in implementing any new legislation.

Economic Cost

After examining all the evidence it has been able to obtain, the committee feels justified in stating that air pollution is at present costing the nation about £250,000,000 a year in terms only of losses that can be given a monetary value. This does not include the value of the fuel that is lost through incomplete combustion, one of the main causes of smoke. This, it is considered, probably amounts to between £25,000,000 and £50,000,000 a year, and represents a waste of coal (possibly as much as 10,000,000 tons) which the nation cannot afford, and may be still less able to afford in the future.

On the question of industrial smoke, the report says that with a few exceptions, no industrial chimney need normally emit more than a light haze of smoke if the combustion arrangements are adequate and are properly operated. This applies equally to commercial and other non-industrial premises, and, of course, to domestic chimneys, which, unlike industrial chimneys, seldom in fact produce dark smoke.

The emission of dark smoke from even the most efficient boiler and steam-raising plant must be regarded as unavoidable for occasional short periods

* The italics are used by the Editor for emphasis.

when fires are being lit, or raked, or during soot-blowing, or in case of mechanical breakdown, and exceptions also must be made for those industrial processes in which according to present knowledge the prevention of dark smoke entails special technical difficulties. These exceptions apart, the committee is satisfied that industrial furnaces can avoid emitting dark smoke. The coal is often blamed, but coal quality by itself is rarely the cause of excessive smoke. Extensive modernization and improvement of plants will be necessary, however, and this will take a few years to accomplish. In particular, the 40,000 or so hand-fired boilers now in use will need additional equipment, for preference mechanical stokers, or, if that is impracticable, they should be fitted with smoke-eliminating devices of proved efficiency such as smoke-eliminator doors of the type designed by the Fuel Research Station. With mechanical stokers, firing is continuous, so that there is little difficulty in maintaining the right rates of supply of primary and secondary air, to avoid excessive smoke and achieve a high efficiency in the use of fuel.

The necessary improvements will require an initial capital outlay, but the whole cost will normally be recouped by the consequent savings in fuel. Under the Government Loan Scheme administered by the Ministry of Fuel and Power capital is available on favourable terms for approved fuel-saving projects in industry. It is recommended that the scope of the loan scheme should be extended forthwith to include projects directed specifically to secure the reduction of air pollution, and industry is urged to make the maximum use of the facilities provided.

It has been represented to the committee that an effective incentive would be to allow the capital cost of new plant and equipment installed to save fuel and to prevent smoke to be charged against revenue for tax purposes in the year in which the expenditure is incurred. Manufacturers installing new plant and equipment are already entitled to tax allowances, *i.e.*, either 20 per cent. investment allowance and 100 per cent. depreciation allowance spread over the life of the asset; or, alternatively, 20 per cent. initial allowance and 80 per cent. depreciation allowance spread over the life of the asset. To allow the whole cost as a charge against revenue in the year in which incurred would mean a smaller relief in total than the former, but the relief would all come in the first year. It has been urged that this would give a material impulse to conversion by smaller firms.

Sulphur Pollution

One of the most deleterious products of the combustion of fuels is sulphur, present in the form of its oxides, mainly sulphur dioxide. Sulphur dioxide is discharged into the atmosphere with the chimney gases wherever fuel in the form of coal, coke, fuel oil, or unpurified gases is burnt. The degree of efficiency of combustion does not affect the quantity of sulphur dioxide evolved. A relatively small proportion of the sulphur contained in solid fuels is retained in the ashes, but the bulk goes into the atmosphere. Coal and coke commonly contain between 1 per cent. and 2 per cent. of sulphur, and the position is likely to get worse since the average sulphur content of coals mined in Britain is steadily rising. Fuel oil frequently contains between 3 per cent. and 4 per cent. of sulphur.

The fuels used annually in Great Britain contain some 3,500,000 tons of sulphur and, allowing for what is retained in the ashes and the amounts recovered in gasworks and elsewhere, the total quantity of sulphur dioxide discharged to the air amounts to about 5,250,000 tons a year. Every industrial and domestic installation which burns fuel other than town gas, purified coke-oven gas or coke in blast furnaces, sends into the atmosphere its quota, great or small, of this invisible but harmful gas.

The obvious initial step in reducing the pollution of the atmosphere by sulphur dioxides is to remove as much sulphur as possible at the pits by cleaning the coal. The National Coal Board now cleans much of the coal and is pressing forward its coal-preparation programme. There is, however, a limit to what can be done in this way and it must be concluded that, while it is important to reduce the sulphur content of coal as much as possible by cleaning before combustion or carbonization, in the present state of knowledge a large proportion of the sulphur cannot be removed by these means. It is technically possible to remove most of the sulphur from fuel oil, but the cost is too great at present for the oil industry to undertake this as a normal commercial operation.

It would be satisfactory if some material could be added to the coal before combustion that would retain the sulphur in the ashes. No practical success has attended efforts to do this so far, but further research could be carried out in this direction.

A method which has received much attention is the washing of sulphur dioxide from the flue gases on their way from the furnace to the chimney. In the present state of knowledge, this method is only practicable in very large installations, and it is now being used only at the Battersea and Bankside power stations in London. A promising and substantially cheaper process which produces sulphate of ammonia as the end product is now on the point of large-scale trials at a power station by the British Electricity Authority.

Domestic Smoke

The report states that nearly half of all the smoke in the air comes from domestic chimneys. The proportion is greater in areas where houses predominate. Further, most of the domestic smoke is produced during the winter months, when foggy conditions are most likely to occur. Although the smoke from domestic chimneys is less dense than that from industrial chimneys, it is discharged at a low level and its harmful effects are thereby accentuated. No cure can, therefore, be found for the heavy smoke pollution of cities and towns unless the domestic chimney is dealt with. In the committee's view there would be little justification for requiring industry and commerce to take all possible measures to prevent smoke, often at considerable cost, if the problem of domestic smoke were not also tackled.

The extension of smokeless zones is advocated where conditions permit. The scope is limited, however, since complete smokelessness is not practicable in areas which include industry as well as houses. The committee contemplates, therefore, a second type of area—a "smoke control area"—which would be on a much larger scale and in which concurrently with the measures proposed to reduce industrial smoke, domestic users would be required to use only smokeless fuels, bituminous coal containing not more than 20 per cent. of volatile matter (and in consequence substantially smokeless) or manufactured fuels having similar smokeless qualities. It recommends the progressive extension of smokeless zones and smoke control areas throughout the black areas under legislative provisions. In addition, it recommends local authorities to make their new housing estates smokeless by requiring the occupiers, as a condition of tenancy, to use only smokeless fuels in the appliances with which they are provided.

Air Pollution Report

The development of smokeless zones and smoke control areas will entail radical changes in the present pattern of domestic fuel use. The problem of domestic smoke is fundamentally different from that of industrial smoke in that bituminous coal can usually be burnt with little smoke in suitable industrial plant, whereas in most of the appliances at present used for domestic heating, it cannot. Smoke can be reduced by the careful use of well-designed closed stoves and of some of the latest improved open fires, but at the present time there is no prospect of developing an open fire, or a stove which could take the place of the open fire, capable of burning bituminous coal smokelessly. At the same time it seems clear that in many parts of this country open fires are likely to remain the usual means of heating houses for many years to come. Any real cure for domestic smoke must, therefore, mean replacing house coal by smokeless fuels, in which the committee includes electricity and gas.

District Heating

One possible means of replacing house coal by a smokeless heating service would be by district heating schemes in which groups of houses would have their rooms warmed and hot water supplied from a central source. Such schemes, however, though both technically efficient and smokeless, are only practicable in special conditions, and in the absence of any simple heat meter, generally uneconomic. The committee therefore seeks the replacement of house coal by direct use of smokeless fuels in individual houses.

In the "black" areas it is estimated that some 19,000,000 tons a year of bituminous coal are now used for domestic purposes, and the committee has reviewed in detail the possible sources of smokeless fuels which would be required to replace this coal. It anticipates an increasing contribution from the continued expansion in the use of gas and electricity, especially for cooking purposes. It considers that their use in place of house coal should be encouraged by the removal of the present purchase tax of 50 per cent. on gas and electric room and water heaters. Both gas and electricity will, however, probably remain more expensive than solid fuel for continuous room heating and this must limit the extent to which they will replace coal. Oil is used, though on a relatively small scale, for domestic heating services, and the committee concludes that for as long as can be foreseen the main substitute for house coal must be solid smokeless fuel.

Fuel

The available solid smokeless fuels are natural smokeless coal, manufactured fuels such as "Phurnacite" and low-temperature cokes ("Coalite" and "Rexco"), coke from coke ovens, and gasworks coke. The National Coal Board anticipates some increase in the supply of its natural smokeless coals and manufactured fuels, and the independent low-temperature coke manufacturers are already expanding their capacity. Some extra coke might be available and suitable for domestic use from the coke ovens. Certain other measures could be taken to provide the necessary increased supplies of coke suitable for domestic use without, it is believed, making impossible demands on the national resources of coking coal. There are quite considerable quantities of solid smokeless fuels, including coke, that could be made suitable for domestic purposes, but which are now being used in plants that could burn bituminous coal or oil with little or no smoke. Here, says the committee, is obvious opportunity for replacing such coke and releasing it.

Increased coke production at gasworks must, however, be the main source of increased coke supply; coking coals and gas coals can be blended satisfactorily with considerable amounts of non-coking coals for the manufacture of coke, and the gas industry could extend the range of coals carbonized. From figures given by the N.C.B. it appears that something approaching half of the coals which are of broadly carbonizable types are not being carbonized. These types of coal are in considerable demand and not all of this coal is available or suitable for carbonization; but much of it is used for purposes for which it could be displaced by oil or non-carbonizable coal and the committee considers that the provision of smokeless fuel should be given priority.

The increasing use of oil should be of considerable assistance in releasing solid smokeless fuel and carbonizable coal. Coke at present used by commercial concerns and public authorities for central heating could, by substitution with oil, be released for domestic use in the black areas. It is understood that over 2,500,000 tons of coke a year are at present being used by Government Departments and other public authorities and it would be open to the Government, if it thought fit, to give a substantial lead in the change-over to oil in this field.

The committee has come to the firm conclusion that by making full use of all the sources of supply the replacement of house coal throughout the black areas by coke and other smokeless means of heating is practicable. Enough coke could be found to permit the creation of smokeless zones and smoke control areas as fast as the administrative action and the replacement of appliances would permit during the next five years at least. The complete programme will take much longer —some 10 to 15 years. By then there may well be new methods of smokeless heating or new sources of supply of smokeless fuels and it is possible that methods will have been developed of burning coal sufficiently smokelessly in domestic appliances, all of which may play a part in the final solution.

Better Coke

Seeing that initially it looks to coke as the main solution, the committee must make it clear that when it speaks of coke it means a high-quality free-burning fuel that will be completely satisfactory to the domestic consumer when used in modern appliances. In some areas such coke is provided and used with full satisfaction. A great deal of coke now produced, however, is not of this quality and measures must be taken to provide an improved fuel by care both in the production of extra coke and in the preparation of existing supplies now sold elsewhere that are transferred to domestic users in the black areas.

The committee is confident that the domestic consumer will ultimately recognize the advantages of a supply of this high-grade fuel and its convenience, coupled with the major advantage of freedom from smoke and dirt. It believes that these advantages will be sufficient to outweigh any moderate increase in coke prices, should such in the event prove necessary.

Coke is sometimes regarded with some suspicion, because it is alleged that when used in stoves or open fires it is liable to cause carbon monoxide poisoning. There are no grounds for apprehension provided proper appliances are used, and they are properly installed, because coke produces no more carbon monoxide than raw coal. A more serious difficulty is that coke—even the improved product envisaged—cannot

be burnt satisfactorily on the majority of open fires now in use. The provision of suitable smokeless fuels is therefore only one part of the solution; *the other is the provision of suitable appliances. This must in fact be the first step, since the improved appliances are a requisite for burning coke satisfactorily.**

It is already the practice of local authorities at the instance of central Government to instal improved appliances capable of burning coke efficiently in the new houses they build. It is recommended by the committee that private builders should be required to to follow the same practice.

Replacing Appliances

In existing houses, the replacement of older appliances could be stimulated by publicity and by an extension of hire-purchase facilities for the improved appliances. Both in smokeless zones and in smoke control areas, however, house owners will be obliged to instal the necessary appliances, where they are at present lacking, in which to burn smokeless fuels. *In most houses one or more open fires, with or without back boilers, and in some others old-fashioned cooking ranges, would have to be replaced by appliances using one or other of the smokeless fuels.* The duty of effecting the necessary replacements should be laid on the owner of the premises, but he should be entitled to assistance towards the cost involved. This would be justified in order to facilitate the extension of smokeless zones and smoke control areas and because the benefits to be gained from smokeless fires would be shared by the community. It is recommended that a substantial contribution should be made from public funds towards the cost of installing approved types of appliances in houses in these areas. The contribution should be defrayed partly by the local authority and partly by the Exchequer. It would be reasonable for the latter to bear 50 per cent. of the total cost and that the local authority should decide in each case how much of the balance it should contribute and how much should be borne by the owner. It should, however, be a condition of the Exchequer payment that some contribution should be made by the local authority, the report states.

The Cost

In the majority of cases the total cost of conversion should not exceed £10 a house; for converting a single open fire it might be less; but in some cases, which may be relatively few, it must be recognized that the cost would be considerably more than £10. The committee has made it clear that it cannot define the pattern that the conversion to "smokelessness" will follow over the whole period. What it is immediately concerned with is the first five years, during which provision for coke-burning appliances must be planned forthwith. It recommends therefore that provision should be made in the first instance for an Exchequer grant not exceeding £15,000,000, which would suffice for the first five years.

* The italics are used by the Editor for emphasis.

Latest Foundry Statistics

According to the British Iron and Steel Federation the average weekly output of steel castings during September was 5,800 tons as compared with 5,000 in August, and again, at 5,800 tons a year ago. The number of employees engaged in the industry on October 9 was 19,592 an increase of 105 over the September figures.

Correspondence

ELECTION QUERY AT GLASGOW

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—Your report under the above heading, on page 634 of your issue of November 25 is decidedly inaccurate. Some of the inaccuracies you could have checked for yourself had you examined the A.U.F.W. *Journal* for November, sent to you by the courtesy of the Union, and in which all the voting details are published.

A protest was received by the Executive Council from a member of the Union, supported by his branch, in regard to the election. That protest was examined and declared frivolous by the National Executive Council, who also described the press campaign behind it, with which the FOUNDRY TRADE JOURNAL has seen fit to identify itself, as irresponsible and damaging to the interests of the Union membership.

No officer of this Union had authority to communicate any information regarding the internal affairs of this Union to you, and it would be appreciated if in future you used the information sent to you officially, and refrained from publishing inaccurate reports, which can only tend to destroy any respect for the columns of your JOURNAL.—Yours, etc.,

J. GARDNER,
General Secretary.

Amalgamated Union of Foundry Workers,
164, Chorlton Road,
Brooks's Bar,
Manchester, 16.
November 29, 1954.

Apprentices to Visit Germany

That travel broadens the mind would appear to be the view held by Steel, Peech & Tozer Branch of the United Steel Companies, Limited, for they have announced that a number of their craft apprentices will spend three months in Germany next year as part of an exchange plan with German apprentices, who will work in this country. The apprentices will spend three months in a works at Rhinhausen, while the German boys work at Steel, Peech & Tozer. The German apprentices are expected next February and the English boys will be going to Germany in May. The idea is to make the boys more adaptable and teach them something of other people's methods of work. The company also considers that the plan will make a useful contribution to international relations.

In his report on the year's education at a presentation of awards to young people of Steel, Peech & Tozer, in Rotherham, Mr. T. H. Hawkins, the company's education officer, said that the firm had probably had greater help from the technical schools than before and the system of selection had improved. It was hoped to repeat the scheme operated last year under which young operatives went to Switzerland for a fortnight's training.

Society of Non-destructive Inspection

In view of the greatly increasing application of non-destructive testing in all branches of the engineering industries, a Society of Non-destructive Inspection has been formed in Great Britain to assist persons responsible for the use of non-destructive examination methods. The headquarters of the new Society is at Duncan House, Dolphin Square, London, S.W.1.

Parliamentary

Technological Education

Both the House of Lords and the House of Commons heard about the Government's detailed plans for the expansion of technological education on December 7.

Lord Salisbury, Lord President of the Council, defined the Government's ideas when he replied to a debate on the subject in the Upper House, while, in th Commons, the matter was dealt with by Mr. Reginald Maudling, the Economic Secretary, during the debate on the Address from the Throne.

The Government's plans, it was stated, provided for a massive expansion of the Imperial College of Science and Technology, South Kensington, major developments at Glasgow, Manchester, Leeds, and Birmingham, development on a fairly large scale at Cambridge and Sheffield, and specialized development in other centres, including Wales. The Government's efforts were being concentrated on institutions already receiving Treasury grants.

It was pointed out that it was increasingly realized that the men who were to hold positions of the highest responsibility in industry needed a broader education than could be given in institutions devoted entirely to technology, or even to science. In training for industry the humanities would have an important part to play. Where there was a technological institution and a university in association—as in London, Glasgow, and Manchester—this linking of studies could be achieved. If new universities were to be established in other centres by upgrading technical colleges it would be necessary to provide them also with departments of pure science and arts, a burden which the Government could not afford. A closer association between industry and the universities was also wanted.

About one eighth of the total recurrent grants to universities was used for technology—about £3,000,000 a year. The Government was making additional recurrent grants for technology of £404,000 for next year and £704,000 for 1956-57. In the next two years there would be an increase in recurrent expenditure of about 25 per cent. in special extra grants, in addition to the extra cost of salaries already announced.

REPLYING to questions about the report of the Beaver Committee on Air Pollution, the Minister of Housing and Local Government said that the committee's recommendations were being considered, and he would make a statement in due course.

THE COST of the United Kingdom delegation to the High Authority of the European Coal and Steel Community was approximately £50,000 per annum, and the staff numbered 14, said Mr. R. H. Turton, Joint Under-Secretary of State for Foreign Affairs.

£130,000 Oil-gas Plant Order

A contract, worth £130,000, has been placed by the Eastern Gas Board with the Power-Gas Corporation, Limited, Stockton-on-Tees, for the construction of a catalytic oil-gas plant at Ponders End (Middx). Production will be 3,200,000 cub. ft. of gas a day, saving daily 200 tons of coking coal. The capacity of the plant will be sufficient to supply a town of about 40,000 inhabitants. The gas produced will be similar to town gas, with which it can be interchanged. The contract includes all ancillary equipment and gas-cooling and naphthalene-removal plant.

Hadfields' Extension Scheme

Lord Dudley Gordon, chairman of Hadfields, Limited, steel manufacturers, Tinsley, Sheffield, spoke at the 46th annual dinner of the firm's Ambulance Society on Saturday, December 4, in the main canteen of the East Hecla Works, Vulcan Road. He referred to the second largest expansion scheme in the firm's modern history now taking place. It includes the construction of two new machine-shops, a modernized heat-treatment division, a new joiners' shop, with roadways and railroads at the Hecla Works, Attercliffe. It is expected that the additional shops will all be in production by next March. Chief items will be mill rolls for the ferrous and non-ferrous rolling mills, for strip and thin sheets. These are exported to many countries outside the "Iron Curtain." Lord Dudley said export work had been built up by the firm with which the world could be faced. He instanced "highly-finished steel products, which in former years, could be obtained only from Germany or the United States." He said the firm was now exporting to North America and Germany and beating them at their own game.

Dr. James Gregory, the company's resident medical officer, said that of 8,600 new accident cases treated at the East Hecla Works in the first nine months of 1954, 3,500 were eye injuries. He said the number must be cut down and asked all to use the safety provisions available free throughout the works. Eye protection was to be improved.

British Industries Fair

Prospects for next year's British Industries Fair in Birmingham, to be held from May 2 to 13, are described as "most encouraging." In an endeavour to extend the scope of the Fair and to attract further support, an "all in" service has been introduced to cover all the details involved in the organization of a Fair exhibit. The service embraces the allocation of site and the provision of stand, together with arrangements for lighting and power installations and for the supply of furniture and the booking of hotel accommodation. There is no other fair in the world, it is claimed, which offers anything in the nature of similar facilities. With regard to cost, it is estimated that an adequate display can be made for less than £1 per sq. ft.

An innovation in next year's publicity, is the decision to use for the purpose 22 commercial radio stations, broadcasting to Australia, New Zealand, South Africa, the Middle East, Ceylon, the West Indies, Brazil, Colombia, Cuba, Mexico and Venezuela. Other points of the campaign include the issue of approximately 90,000 invitations and booklets of information to selected overseas buyers. Government information officers are to be responsible for the issue of 40,000 more, and about 80,000 home buyers will receive invitations. Posters, in nine languages, will be displayed and extensive publicity at home is to be augmented by advertising in 26 countries abroad, in which 16 languages will be used.

A SPECIAL DEMONSTRATION of the new 60-ton electric-arc furnace of Samuel Fox and Company, Limited, Stocksbridge, near Sheffield, was given on Wednesday, December 8. It is the largest in Europe and was commissioned last month and will produce 60,000 tons of alloy steels a year. Samuel Fox is a branch of the United Steel Companies, Limited.

Personal

MR. JOHN BISHOP has been appointed secretary of the Gas Purification & Chemical Company, Limited, London, E.C.2.

MR. TOM CARPENTER, who has been docks manager at Barry (Glam), since 1946, has retired after 50 years' railway service.

MR. E. J. GADSBY, secretary of the Stainless Steel Manufacturers' Association since its formation in 1930, has retired. At a luncheon in Sheffield recently he was presented with a camera and a stainless tea-service. Mr. Gadsby's successor is MR. J. CLARKE.

SMITH, BINGLEY & EVANS, LIMITED, general ironfounders and patternmakers, of Tower Foundry, Aston Road North, Birmingham, 6, announce that MR. J. F. EDWARDS (works manager) and MR. A. E. BAILEY (company secretary) have been elected to the Board of directors.

MR. PETER G. ROBERTS has been appointed chairman of Newton Chambers and Company, Limited, as from January 1. SIR SAMUEL ROBERTS, chairman of Newton Chambers and N. C. Thorncliffe Collieries, has tendered his resignation from the Boards of both companies as from December 31.

MR. J. STANLEIGH TURNER has been re-elected president of the Coal Utilization Council for the seventh successive year. Sir JOHN CHARRINGTON has been re-elected vice-president. They were both, with SIR WILLIAM MCGILVRAY and MR. H. V. SHELTON, elected as trustees of the Council for another year.

IN THIS COLUMN of the JOURNAL for November 25, MR. A. S. BEECH was accorded an incorrect initial, when it was announced that, with others, he had been accepted as Liveryman of the Worshipful Company of Founders and made a Freeman of the City of London. Apologies are tendered to any who may have been confused.

MR. W. G. HEATH, chief cashier, was among more than 80 members of the works and head office staff of the English Electric Company, Limited, at Stafford who received long-service presentations recently. He went to Stafford in 1930 and has been with the company and one of its predecessors for 52 years.

MR. H. KNIGHT has been appointed superintending engineer of the Orient Line. He was born in 1906 and served his apprenticehip with Vickers-Armstrongs, Limited. Before the war he was assistant engineering manager of the naval yard. He joined the Orient Line in 1946 as assistant to MR. J. D. CAMERON, whom he now succeeds.

DR. A. G. TOUCH, who is 43 and has been deputy director, electronics research and development (air), since 1952, has been appointed director of electronics research and development at the Ministry of Supply in succession to Air Commodore W. G. PRETTY. Air Commodore C. A. BELL, who will succeed Dr. Touch, is 49 and was deputy director, communication development, from 1946 to 1948.

MR. A. J. BRUNKER has relinquished his position as general export manager of E. K. Cole, Limited, electrical and radio engineers and manufacturers, etc., of Southend-on-Sea, to become chief engineer of the company. He will be responsible to Mr. A. W. Martin, the company's technical director, and will assist him in the general administration of the development and engineering department. Mr. Brunker will retain his directorship of Ekco Electronics, Limited, a subsidiary of E. K. Cole, Limited.

THE FIRST general manager of the new industrial Credit and Investment Corporation of India will be MR. P. S. BEALE, chief cashier of the Bank of England, who is resigning in January, with the Bank's approval, to take up that position. The post was offered to Mr. Beale by the steering committee of the new Corporation, subject to formal confirmation by the Board of directors when appointed. Mr. Beale, who is 48, joined the Bank of England as a youth of 18, and made rapid progress in a variety of posts until becoming chief cashier in 1949. He was secretary of the Reserve Bank of India from 1937 to 1939, and during the war spent most of his time as assistant chief cashier in exchange control. He left London by air recently for the United States, where he has been in Washington having talks concerning his new appointment with World Bank officials. He left for India last week.

Obituary

THE DEATH has occurred of the chairman of Armstrong Shock Absorbers, Limited, COL. JAMES D. MACINDOE.

THE DEATH took place on December 4 of MR. ERNEST MILLINGTON, at the age of 81. He was a former chief metallurgist of the L.M.S. Railway at Derby.

THE DEATH has occurred of MR. EDWARD MCCARTHY, managing director and secretary of the Gas Purification & Chemical Company, Limited, London, E.C.2.

MANAGING DIRECTOR since 1936 of Peterbcrough Die Casting & Machine Company, Limited, MR. HUBERT ARTHUR STOCK died on November 29 at the age of 52.

MR. GEORGE WILLIAM HAIGH, who has died at the age of 84, was a director of John Haigh & Sons, Limited, ironfounders and textile-machinery makers, of Huddersfield.

MR. ARTHUR ROBERT TOZER, sales manager of Wadkin, Limited, woodworking-machinery engineers, of Leicester, died on December 1 at the age of 58. He moved from London to Leicester some 30 years ago and had been with the company ever since.

SIR JOSEPH DAVIES, who died recently at the age of 87, was formerly a director of Cambrian Railways, and chairman of the Totton & Fawley Light Railway Company and the Agwi Petroleum Corporation. He represented Wales on the Cabinet committee on unemployment from 1914 to 1917.

MR. HAROLD BARKER, manager of the Newcastle upon-Tyne office of Babcock & Wilcox, Limited, has died at the age of 49. Mr. Barker had been with the company since 1921, except for a short period in 1927 and 1928. He had had extensive sales experience in Leeds and London, and was appointed manager of the Newcastle office in 1950.

MAJOR V. F. GLOAG, London director of Simon-Carves, Limited, died on November 28 at the age of 65. He was with the company for 35 years and had been a director since 1926, having charge of the chemical plant department from 1920 to 1945, when he took up his London appointment. He was a former president of the Institution of Chemical Engineers.

"Soaking" the Founders

It is regretted that an obvious error appeared in the artic'e bearing the above caption in last week's issue of the JOURNAL. The figure of 6s. 3d. per ton should have been 16s. 3d. per ton—midway between the increase in the cost of pig-iron (12s. 6d.) and scrap (£1).

News in Brief

THE EAST ANGLIAN SECTION of the Institute of British Foundrymen are holding a meeting in the Central Hall, Public Library, Ipswich, at 7.30 p.m. on December 21 when the subject will be "Fault and Cure."

EMPLOYEES who have recently completed 25 years' service at Sterling Metals, Limited factories at Coventry and Nuneaton, were presented by Lord Burghley, chairman of Birmid Industries, Limited, with certificates.

GEORGE BROWN & COMPANY (MARINE), LIMITED, Greenock, have received a contract to build two 95-ft. tugs for the Alexandra Towing Company, London. Less than two months ago, the same builders received a contract for a motor coaster of 1,350 tons dw. for the Zillah Shipping Company, Liverpool.

WELLMAN, SMITH, OWEN, ENGINEERING CORPORATION, LIMITED, steelworks, plant and furnaces, Ecclesall Road, Sheffield, have secured a contract for the supply of two sets of coke-oven machinery to be incorporated in the £3-million coking plant being carried out by Simon Carves for the Indian Iron and Steel Company.

THE MIDLAND REGION took the lead over the North Midland Region last month, as having the lowest percentage of unemployed in the country. Both had the abnormally low percentage of 0.5 per cent. in mid-October. In November, the North Midland percentage rose to 0.6 while the Midland percentage remained unchanged.

THE INSTITUTION OF PRODUCTION ENGINEERS is organizing a third aircraft production conference to be held at the University of Southampton on January 14 and 15 and based on the theme: "Integral Construction Contrasted with Traditional Methods." Details are available from the Institution, 10 Chesterfield Street, London, W.1.

THE SPORTS AND SOCIAL CLUB of J. and J. Dyson, Limited, refractory goods and fireclay works, Stannington, Sheffield, held their annual dinner in the works canteen on December 6. Prizes were presented by Mr. A. Lomas, governing director of the firm, and Mr. H. Hughes, cricket secretary of Sheffield and District Works Sports Association.

MAY 14 TO 30, 1955, is the period fixed for the next *Foire de Paris*, which covers all aspects of production in a manner similar to that of the British Industries Fair. Heavy industries are well represented. The participants in the *Foire de Paris* from countries other than France has risen significantly—from about 200 in 1948 to 2,000 in this year's show.

SEVERAL ITEMS of interest to foundrymen are included in the exhibition of portable and semi-portable electric power tools which opened on December 6 at the Midland Electricity Board's Industrial Showroom at Chester Street, Aston, organized by Power Tools (Birmingham), Limited, in conjunction with the M.E.B. The exhibition will remain open until December 17.

LOBNITZ & COMPANY, LIMITED, Renfrew, have received a contract from the Crown Agents for the Colonies for a combined bucket dredge and rock-cutter. The vessel, which will be non-propelled, is to be fitted with buckets of 8-cub. ft. capacity, and is to have 10-ton rock-cutting equipment fitted to the dredger. The machinery will be steam-driven. The vessel is intended for service at Takoradi on the Gold Coast.

BRITISH INSULATED CALLENDER'S CABLES, LIMITED announce that their branch offices at Exeter and Plymouth each have additional telephone numbers—Exeter 67308 and 3514 and Plymouth 60257 and 65151. British Insulated Callender's Construction Company, Limited, announce that the address of their Middlesbrough district office is now 55/57, Borough Road, Middlesbrough, telephone number 43644.

PROVISIONAL figures issued by the Central Statistical Office indicate a new record for industrial production in the United Kingdom during October. The index for all industries (1948 = 100) is estimated at 134-135 in October, compared with 130 in September and 131 in October, 1953. The previous highest index number reached was 133 in November last year. The average for the first 10 months of this year is 126.3, compared with 120.4 in the corresponding period of 1953.

SHEFFIELD SOCIETY OF ENGINEERS AND METALLURGISTS held their annual general meeting in Mappin Hall, St. George's Square, Sheffield, on Monday, December 6, when Mr. W. Udall gave a talk on the Parkgate 11-inch Continuous Mill. Officers elected were:—Mr. R. E. S. Fisher, as president; Mr. L. K. Everitt, Professor R. J. Sarjant, Mr. H. Bull, Mr. E. D. Bool, and Mr. F. H. Saniter, as vice-presidents; Mr. L. K. Everitt, hon. treasurer; and Mr. E. J. Thackeray, secretary.

AT THE PRESS CONFERENCE of the Regional Board for for Industry in Leeds, on December 7, the Board of Trade reported that the industries in the East and West Ridings of Yorkshire continue in general to be very busy, with no indication that any important change in the position is likely. It was stated that the machine-tool industry has full order-books and there exists a world-wide demand for engineering products. The steel industry in the Sheffield district continues to break output records.

THE SHEFFIELD INSTITUTE OF WORKS MANAGERS was addressed by Mr. R. J. Stevenson, a personnel management adviser to the Ministry of Labour on "Disciplinary Policy in Industry" on December 8. He said that the methods of maintaining discipline by fear have been replaced by a system founded on justice and what is reasonable and makes sense to management and employees. "Men have never liked to be driven," he added, "I think the firms with the best discipline to-day are those which have the highest morale and the best team-spirit. Their workers are usually the most efficient."

WHEN Sir Hugh Beaver, chairman of the Air Pollution Committee, addressed the conference of the Combustion Engineering Association at Harrogate on December 8, he advocated state assistance for industry in its effort to overcome air pollution. He said that the cost of this work should be borne in mind at this time when the derating of industrial premises was under review. The export drive, he suggested, would be affected by the war on smog. In the home market, the cost of clean air could be passed on to the consumer; those who benefited would pay, but it would add to costs of exports and this would be a burden which it could legitimately be claimed should be borne nationally as the nation benefited.

OPENINGS for British exporters in the states forming the gateway to the Middle West—Michigan, Ohio, and parts of Pennsylvania and West Virginia—exist if salesmen are prepared to make personal visits. British Consular officials in the area, which has a population and purchasing power greater than the whole of Canada, have made a market survey for the Board of Trade in which they state that a great many potential buyers are there but for them, no amount of correspondence can equal a personal visit. Large companies are looking

(*Continued on page* 736)

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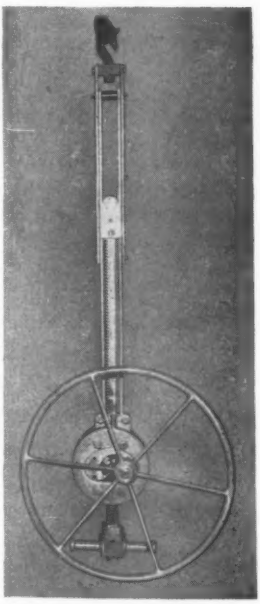

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News in Brief

(*Continued from page* 734)

towards the United Kingdom for the possibility of building factories, or making arrangements with British firms for partnerships or the exchange of technical data.

THE BRIGHTSIDE FOUNDRY & ENGINEERING COMPANY, LIMITED, Sheffield, have received a contract from the Société Métallurgique d'Imphy, France, for a bar and continuous rod mill for the production of precision alloy-steel bars and rods in straight lengths and coils. Provision is made for the plant to also roll strip. The new plant will be located adjacent to existing mills at Imphy (Nièvre). The value of the mechanical equipment is considerably over £½m. sterling and the contract provides that some parts are to be made in France to Brightside designs. Société Métallurgique d'Imphy, formerly known as S.A. Commentry-Fourchambault et Décazeville, are well known for their high-quality alloy steels, and operate blast-furnaces, open-hearth furnaces and electric furnaces, together with rolling mills, forges and foundries.

THE GENERAL ELECTRIC COMPANY, LIMITED, announces that its Fraser & Chalmers Engineering Works, Erith, Kent, have been awarded a contract for a turbo-blower to be installed at the Clyde Iron Works, Tolcross, Glasgow, of Colvilles, Limited. The output of the machine is to be 75,000 cub. ft. of dry air per min. at 60 deg. F., and a delivery pressure of 25 lb. per sq. in. The turbine—a multi-stage, single-casing, high-pressure machine—will be supplied with steam at 270 lb. per sq. in. gauge pressure at a total temperature of 750 deg. F. and drive the four-stage centrifugal blower at 2,750 r.p.m. The control of the machine will be by a constant-volume, anti-surge regulator of the Ascania type. The contract includes surface-condensing plant and auxiliaries.

ALLOWING VERY FEW SITES for heavy industry in the city of Leeds was a very short-sighted policy, said Mr. Alfred H. Catton, vice-chairman of the Leeds Association of Engineers at the Association's 89th annual dinner at the Hotel Metropole on Saturday, December 4. He said the city had been built up on heavy industry, and there should be second thoughts about the allocation of sites for its development. Replying, the Lord Mayor, Councillor H. S. Vick, said he was not an expert on town planning and he felt the question must be left to the experts. "We must realize that to-day's present standards have only been achieved by those who preceded us. Engineering has had its place in our town and city since the 18th century. I suppose it would be true to say that Leeds can produce anything from a washer to a locomotive."

MR. GEORGE LANCHESTER, one of the three Lanchester brothers who contributed so much to the development of the modern motor car, celebrated his 80th birthday on December 11. In 1895, he assisted his brother Fred in manufacturing and assembling the first British-built four-wheel petrol-driven car, which Fred had designed, and in 1897 he became technical assistant to Fred at the experimental workshop which the brothers set up in Ladywood Road, Birmingham. There, experimental cars were manufactured, including the three-seater Phaeton which is now in South Kensington Museum and which was awarded a Gold Medal at the Richmond Motor Trials in 1899. The experimental work of the Lanchesters culminated in the production of a 10-h.p. air-cooled car which was later manufactured at the Lanchester Motor Company's works in Montgomery Street, Sparkbrook, Birmingham.

THE EGYPTIAN MARKET is now "wide open" again, Mr. L. M. Minford, First Secretary (Commercial) at the British Embassy in Cairo, said on December 3, in Birmingham. Mr. Minford is visiting industrial centres in Great Britain with the object of stimulating exports to Egypt. He is to return to Cairo in the New Year at the time of the visit to Egypt of a trade delegation headed by Sir Edward Benthall. The Canal Base agreement was taking wellknown British concerns such as the British Motor Corporation, I.C.I., and Rootes, out to Egypt again, he said. The reputation of British goods was still extremely high, but there was very keen, world-wide competition. West German exports for instance, had risen from £200,000 in 1949 to nearly £20,000,000 in 1953. British exports, on the other hand, had dropped from about £40,000,000 in the years 1949, 1950 and 1951 to £18,000,000 last year. The reason for this decline was Egypt's lack of sterling, but the import ban imposed because of that shortage had now been completely removed. Egypt was now well supplied with sterling again.

THE LARGEST SINGLE slugger-roll crusher ever produced by Sheepbridge Equipment, Limited, of Chesterfield, one of the Sheepbridge Group, together with other mining plant, is being despatched to Malaya for dealing with the overburden at an open-cast coal mine there. This Sheepbridge mining plant and equipment is supplied through Mining Engineering Company, Limited, of Worcester, for Malayan Collieries, Limited. The open-cast coal mine at Batu Arant, near Kuala Lumpur, is the largest in Malaya, and has an overburden over 200 ft. deep in places. The heavy-duty Sheepbridge apron feeder will be used in conjunction with the 48-ton Sheepbridge crusher, which will regularly handle large lumps of shale of up to 4 ft. by 4 ft. by 1 ft. 6 in. in size. The shale is brought in dumper trucks and tipped on to a concrete chute built into the hillside and passes directly on to the apron feeder which feeds the crusher at a steady rate varied by a simple hand-wheel on the feeder drive-unit. The crusher reduces the large lumps of shale from the apron feeder to less than 10 in. The crushed material is then carried by a belt conveyor system to a spreader device, built of Sheepbridge components, to fill-in old open-cast workings.

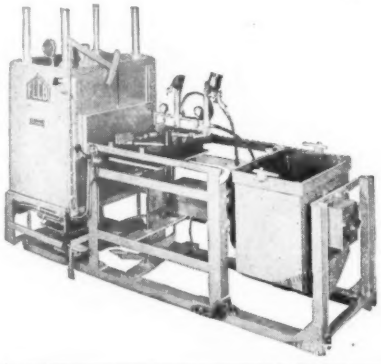
New Non-ferrous Metals Chairman

Dr. Maurice Cook (joint managing director of the Metals Division of Imperial Chemical Industries) has been elected chairman of the British Non-Ferrous Metals Research Association as from January 1 in succession to the Hon. R. M. Preston, who retires from office at the end of this year.

Dr. Cook is a graduate of both Cambridge and Manchester Universities and is distinguished for his services to the metallurgical industry and profession. He has made many contributions to the science and technology of non-ferrous metallurgy in numerous published papers. He is a past-president of the Institution of Metallurgists and senior vice-president and president-elect of the Institute of Metals. He is a member of Council of the Aluminium Development Association and has served over many years on a large number of industrial and Government councils and committees dealing with metallurgical matters. He has been active in the affairs of the Research Association for many years, having been a member of Council since 1940, a vice-chairman since 1951, and a member of the Finance and General Purposes Committee since 1942. He has been chairman of the research board since 1950.

SHELL MOULDING AT LOW COST

The Shelmolda 'Duplus' is low in first cost, economical to operate and costs little to maintain. Its design is simple and straightforward, yet it has the advantages of more complicated and costly apparatus. Operation is semi-automatic, with all the strenuous work carried out mechanically. The patent oven is thermostatically controlled and gives the machine a proved capacity of 50/60 moulds per hour. Pattern plates measure 24in. by 16in. and the maximum depth of pattern is 5in. Floor space required is 8ft. 6in. by 3ft. 3in. and the machine is operated by one man. Cost of the Shelmolda 'Duplus' is £575; delivery is 8 to 10 weeks.



Shelmolda

DUPLUS

PATENT APPLIED FOR

FAIRBAIRN LAWSON COMBE BARBOUR LTD

LEEDS, ENGLAND. Telephone : Leeds 32041

236/73

Raw Material Markets

Iron and Steel

Although foundrymen have had to accept the recent increases in pig-iron prices, they are not yet reconciled to them. Since the beginning of the year the rise in the price of foundry iron has amounted to 34s. per ton and it is affirmed that the effects upon the export trade in iron castings will be serious. On the other hand, it is pointed out that the producers of foundry iron have had to meet the heaviest increase in the cost of production. Using as they do low-grade home ores and scrap, they require a relatively high consumption of coke, which is both scarce and expensive.

The rise in basic iron is very largely a matter of bookkeeping, since the big steel companies provide the bulk of their own supplies, but output still falls short of requirements and large tonnages of foreign iron have been bought to bridge the gap until some of the new blast furnaces now building come into operation.

Supplies of steel semis are running short and arrangements have been made to secure increased tonnages from the Continent. In the meantime, re-rollers are eagerly taking up defectives and crops to eke out their meagre stocks of prime billets.

The boom in the finished steel trade seems to be gathering momentum with every week that passes. Home demand is overwhelming and overseas buyers are willingly paying premiums over and above the maximum home prices for reasonably prompt shipments. Heaviest pressure is for sheets and sections, and makers' bookings now extend as far ahead as the end of June.

Non-ferrous Metals

Trading in non-ferrous metals so far this month has kept going well and there is an absence of the usual holiday influence in evidence at this time of year. Copper gave a spectacular display last week, cash closing £2 below the best at £285, while three months, after reaching £269, finished at £268 5s. On balance, cash gained £13 and three months £7 5s., and the backwardation, which a week earlier was £11, widened to about £17. Business with consumers was reported to be good in spite of the rising price.

The other metals made no great display, although zinc was rather surprisingly firm, for it was up £2 for the current half month and 15s. better for the forward position. In the United States the National Lead and Zinc Committee is maintaining that the Government's stockpiling programme has not gone very far in helping the zinc and lead mining industry. Apparently, too much foreign metal is still coming in, to the detriment of the domestic producer, and the committee wants the authorities to take some action.

The lead price was up by 10s. last week on the London Metal Exchange, the backwardation remaining at £1. Tin was not very active and some ground was lost, cash closing £3 down and three months 10s. lower on balance.

The recent uprush of the copper price on the exchange has brought new comments and complaints from many directions, all pointing out that there is no fresh development to account for this, at least not in the world situation. But in Whittington Avenue it would appear that some reduction has taken place in the tonnage available for trading, since the prompt price has advanced faster and farther than the three months quotation. No further news has come to hand regarding the projected plan attributed to a section of the Commonwealth producers to stabilize copper at a lower level, but the behaviour of the market suggests that the scheme has not had much effect on the price structure here. Everything seems to suggest that copper will remain firm over the turn of the year.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* December 9, £285 to £286; December 10, £286 to £287; December 13, £282 10s. to £283 10s.; December 14, £276 10s. to £277.

Three Months: December 9, £268 10s. to £269; December 10, £268 15s. to £269; December 13, £267 10s. to £268 10s.; December 14, £265 to £265 10s.

TIN, Standard—*Cash:* December 9, £718 to £718 10s.; December 10, £715 10s. to £716 10s.; December 13, £712 to £713; December 14, £712 10s. to £713.

Three Months: December 9, £716 to £717; December 10, £715 to £715 10s.; December 13, £712 to £712 10s.; December 14, £712 10s. to £713.

ZINC—*First half December:* December 9, £81 15s. to £82; December 10, £82 10s. to £83; December 13, £83 to £83 5s.; December 14, £83 15s. to £84.

First half March: December 9, £81 15s. to £81 17s. 6d.; December 10, £82 to £82 10s.; December 13, £82 10s. to £82 12s. 6d.; December 14, £82 15s. to £83.

LEAD—*First half December:* December 9, £104 10s. to £104 15s.; December 10, £104 5s. to £104 10s.; December 13, £103 10s. to £103 15s.; December 14, £103 5s. to £103 10s.

First half March: December 9, £103 10s. to £103 15s.; December 10, £103 5s. to £103 10s.; December 13, £102 15s. to £103; December 14, £102 15s. to £103.

Increases in Capital

HATTERSLEY (ORMSKIRK), LIMITED, increased by £250,000, in 5s. ordinary shares, beyond the registered capital of £500,000.

BROWN & TAWSE PLANT, LIMITED, London, E.3, increased by £25,000, in £1 ordinary shares, beyond the registered capital of £5,000.

W. & T. AVERY, LIMITED, Birmingham, increased by £1,000,000, in £1 ordinary shares, beyond the registered capital of £2,250,000.

ST. GEORGES ENGINEERS, LIMITED, Salford (Lancs), increased by £84,000, in £1 ordinary shares, beyond the registered capital of £12,000.

B.H.D. ENGINEERS, LIMITED, London, S.W.1, increased by £150,000, in 10s. ordinary shares, beyond the registered capital of £650,000.

SMITH & MCLEAN, LIMITED, iron and steel manufacturers, etc., of Glasgow, increased by £900,000, in £1 ordinary shares, beyond the registered capital of £350,000.

GEO. HENDERSON, LIMITED, steel and metal merchants, etc., of Kelso (Roxburghshire), increased by £80,000, in £1 ordinary shares, beyond the registered capital of £45,000.

ALEXANDER STEPHEN & SONS, LIMITED, ship builders and repairers, etc., of Glasgow, increased by £400,000, in 5s. ordinary shares, beyond the registered capital of £350,000.

BROOM & WADE, LIMITED, High Wycombe (Bucks), increased by £750,000, in 2,500,000 ordinary and 500,000 unclassified shares of 5s. each, beyond the registered capital of £1,000,000.

W. J. JENKINS & COMPANY, LIMITED, gas, conveying, and structural engineers, etc., of Retford (Notts), increased by £160,000, in £1 ordinary shares, beyond the registered capital of £150,000.

NETTLEFOLD-STENMAN HINGES, LIMITED, Cardiff, increased by £100,000, in £1 ordinary shares, beyond the registered capital of £200,000. Guest Keen & Nettlefolds, Limited, holds nearly all the issued shares.

PETER LIND HOLDING COMPANY, LIMITED, engineers, contractors for reinforced-concrete construction, etc., of London, S.W.1, increased by £180,000, in £1 ordinary shares, beyond the registered capital of £180,000.

NORTON GRINDING WHEEL COMPANY, LIMITED, Welwyn Garden City (Herts), increased by £200,000, in £1 ordinary shares, beyond the registered capital of £300,000. At July 23, 1953, the Norton Company, Worcester, Mass., USA, held a majority of the issued shares.

HOOKERLITE CORE TRAYS

are

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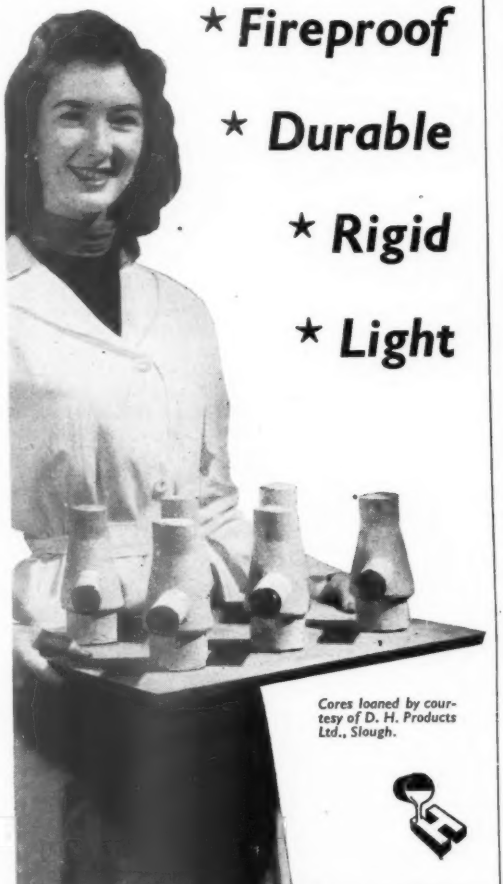
★ *Fireproof*

★ *Durable*

★ *Rigid*

★ *Light*



Cores loaned by courtesy of D. H. Products Ltd., Slough.

W. J. HOOKER LTD.
4 MIDLAND CRESCENT, LONDON, N.W.3
Phone: HAMpstead 2495 & 4537

British steel builds Alaskan fuel highway

On the morning of the 9th April, 1954, the s.s. 'Klaus Schoke' sailed from Glasgow with more steel pipes in her holds than had ever been loaded on one ship before.
She was bound for Alaska. There, this British steel will build a fuel pipeline. It will stretch from Haines to Fairbanks and follow part of the route of the famous Alaska Highway.
Wherever there is steel there is British steel.

British steel leads the world

S.87 THE BRITISH IRON AND STEEL FEDERATION

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

December 14, 1954

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £15 12s. 0d.; Birmingham, £15 5s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £17 13s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £18 9s. 3d.

Scotch Iron.—No. 3 foundry, £18 2s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £20 4s. 0d.; South Zone, £20 6s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £21 1s. 6d.; South Zone, £21 4s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £18 2s. 6d.; Scotland (Scotch iron), £18 9s. 0d.; Sheffield, £19 7s. 6d.; Birmingham, £19 14s. 6d.; Wales (Welsh iron), £18 9s. 0d.

Basic Pig-iron.—£15 15s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots).—40/55 per cent., £42 0s. 0d., basis 45 per cent. Si, scale 17s. per unit; 70/84 per cent., £65 0s. 0d., basis 75 per cent. Si, scale 18s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £185 0s. 0d. to £195 0s. 0d. per ton; 38/40 per cent., £251 0s. 0d. to £270 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 14s. 0d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 17s. 0d. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £75 0s. 0d. to £80 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £74 0s. 0d. to £76 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; 2 per cent. C,* 1s. 7½d. per lb. Cr; 1 per cent. C,* 1s. 8d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. per lb. Cr; 0.10 per cent. C,* 1s. 9½d. per lb. Cr; 0.06 per cent. C,* 1s. 10d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 6½d. to 7s. 1d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £225 5s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £255 0s. 0d. to £262 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 52s. 6d. to 70s. 0d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £54 15s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 5s. 0d.; tested, 0.08 to 0.25 per cent. C, £26 5s. 0d.; hard (0.41 to 0.60 per cent. C), £27 10s. 0d.; silico-manganese, £34 10s. 0d.; free-cutting, £29 6s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 17s. 0d.; silico-manganese, £34 10s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 13s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 15s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £31 1s. 6d.; boiler plates (N.-E. Coast), £33 11s. 6d.; floor plates (N.-E. Coast), £32 10s. 6d.; sectional material, N.-E. Coast, £29 4s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 19s. 6d.; flats, 5 in. wide and under, £31 19s. 6d.; hoop and strip, £33 1s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £34 5s. 0d.; black sheets (hand mill), 17/20 g., £43 13s. 6d.; galvanized corrugated sheets, 24 g., £54 10s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £54 7s. 9d. nickel-chrome, £76 7s. 9d.; nickel-chrome-molybdenum, £86 8s. 6d.

NON-FERROUS METALS

Copper.—Cash, £276 10s. 0d. to £277 0s. 0d.; three months, £265 0s. 0d. to £265 10s. 0d.; settlement, £277 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 33d. per lb.; wire, 320s. 6d. per cwt. basis; 20 s.w.g., 351s. 9d. per cwt.

Tin.—Cash, £712 10s. 0d. to £713 0s. 0d.; three months, £712 10s. 0d. to £713 0s. 0d.; settlement, £713 0s. 0d.

Zinc.—First half December, £83 15s. 0d. to £84 0s. 0d.; first half March, £82 15s. 0d. to £83 0s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £113 10s. 0d.; rolled zinc (boiler plates), all English destinations, £115 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £96 0s. 0d.

Lead (Refined Pig).—First half December, £103 5s. 0d. to £103 10s. 0d.; first half March, £102 15s. 0d. to £103 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 26½d. per lb.; rods, drawn, 35⅞d.; sheets to 10 w.g., 291s. 0d. per cwt.; wire, 33⅝d.; rolled metal, 277s. 3d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £186; B6 (85/15), £234; BS249, £190.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £220; HTB2 (30 tons), £231; HTB3 (48 tons), £240.

Gunmetal.—RCH, 3/4 per cent. tin, —; BS1400, LG2 (85/5/5/5), £235; LG3 (86/7/5/2), £244; G1 (88/10/2/½), £307; (88/10/2/1), £302.

Phosphor Bronze.—BS1400, PB1 (AID released), £321 per ton.

Phosphor Bronze Strip, etc.—Strip, 409s. 9d. per cwt.; sheets to 10 w.g., 432s. 3d. per cwt.; wire, 50½d. per lb.; rods, 44d.; tubes, 42½d.; chill cast bars: solids 44d., cored 45d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 5½d. per lb.; round wire, 10g. in coils (10 per cent.), 3s. 11d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 10d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £110 0s. 0d. Nickel, £519 0s. 0d. Aluminium, ingots, £156 0s. 0d.; aluminium bronze (BS1400), AB1, £283; AB2, £293. Solder, brazing, BS1845, 2s. 3d. lb.; granulated, 2s. 6d. lb.

* Average 68-70 per cent. Cr.

Company News

R. W. CRABTREE & SONS, LIMITED, makers of printing machinery, of Leeds—An extra-ordinary meeting is called for December 22 to create capital and effect the one-for-one scrip issue for holders at November 27. The issue, which follows an asset revaluation, capitalizes £600,000.

UNIVERSAL GRINDING WHEEL COMPANY, LIMITED—The directors recommend a final dividend for the year ended September 25, of 10 per cent., tax free, on £451,008 ordinary and employees stocks. An interim of 10 per cent., tax free, was paid on £409,488 ordinary and employees stock before a 10 per cent. scrip issue. The total dividend absorbs £86,034 against the £81,861 required to pay 20 per cent. net on the smaller capital for the previous year.

PICKFORD, HOLLAND AND COMPANY, LIMITED, Eclipse Canister Works, Attercliffe Road, Sheffield, announced in their annual report issued at Sheffield on December 1 that alterations planned for the Crook Works, Co. Durham, were completed in the summer, and the head-office staff of the company was removed during the year from overcrowded and unsatisfactory conditions in Attercliffe to new offices in Fulwood Road, Sheffield. This move has led to increased efficiency.

CROFTS ENGINEERS (HOLDINGS), LIMITED, Bradford—Mr. John A. Croft, deputy chairman of Croft Engineers (Holdings), Limited, Bradford, took the chair at the annual dinner of the firm at the Midland Hotel, Bradford, in the absence, through ill-health, of his father, Sir Arthur Croft. He reported that trade in the past year had very greatly improved and forecast a very full year in 1955 with all departments working at top speed. He attributed this happy position to the increasing trade from home and overseas markets, not forgetting their sales department. By the year-end, the office and works reorganizations would be completed, and these, except for one other extension in view, would complete all foreseeable expansion. Among the important developments which had taken place during 1954, the most important was the acquisition of J. Parkinson and Son (Shipley), Limited, machine makers, and the directors of Crofts had not the slightest doubt that this would enhance the prestige of Crofts as well as, in time, the financial results.

STAVELEY IRON AND COAL COMPANY, LIMITED, reported at the 91st annual general meeting on December 1 an increase in the total earnings of the group. They rose from £1,521,113 last year to £2,198,458 this year. Taxation absorbs £1,229,373 or 56 per cent. of the profit. A final dividend of 10½ per cent. makes a total of 15 per cent., less tax. Eight years ago the company were major producers of coal, iron and heavy chemicals, and to a lesser extent of salt, lime and various engineering products. Now their major interests are in engineering products (mainly machine-tools) both here and in Canada, and to a lesser extent in salt, lime, refined iron, metallic abrasives and machinery for the use thereof, concrete products, oils and greases, food chemicals and electrical contracting. The group has a minority interest in D. and C. and William Press, Limited, civil-engineering contractors with many important contracts in the Middle East, India and Australia. The statement says that the changes in the company's activities were caused by the nationalization of coal, iron and steel.

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LIVERPOOL, 2. 13, Rumford St., Central 1558
GLASGOW, C.2. 93, Hope Street, Central 9969

CLASSIFIED ADVERTISEMENTS

PREPAID RATES: Twenty words for 5s. (minimum charge) and 2d. per word thereafter. Box Numbers 2s. extra (including postage of replies).

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House, 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Tuesday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

FOUNDRY MANAGER, 42, desires change. Southern half of the country preferred. Accustomed to full control. Sound basic training and proved ability in both ferrous and non-ferrous. Good disciplinarian with metallurgical training and fully up to date in mechanisation methods and developments, including shell, etc. Box FM930, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER of Malleable and High Duty Grey Iron Foundry seeks similar position in the South of England. Financial interest considered. All replies in strictest confidence.—Box FM919, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (45) free for similar position. Sole control. Life experience in practical and technical. Cupola control, marine, machine tool, sugar refinery, sand control, mechanisation. Guaranteed results. M.I.B.F.—Box FM949, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

A TECHNICAL REPRESENTATIVE is required by Bagshawe & Co., Ltd., Dunstable Works, Dunstable, to handle sales of Malleable Iron Castings. Previous experience of foundry sales and/or some practical foundry experience an advantage. Applications, which will be treated in confidence, must state full details of experience and salary required.

FOUNDRY MANAGER required for mechanised Malleable Iron Foundry in West Riding. Fully conversant with mass production light precision castings. House available. Please give previous experience, age and salary required. Box FM932, FOUNDRY TRADE JOURNAL.

PATTERN SHOP MANAGER required in Yorkshire, to develop pattern shop to produce precision metal patterns and coreboxes for mass production of light castings. Box PS933, FOUNDRY TRADE JOURNAL.

PATTERNMAKERS required, used to first-class Wood and Metal work. Excellent conditions, canteen, music while you work, etc., top wages and bonus, by the oldest (85 years) established firm, with the absolute highest reputation. Main suppliers for many years to all firms of importance in the entire country and the finest Plant and Equipment in the world.—Apply WRIGHT & PLANT, LTD., the World's Largest Engineering Patternmakers, Irving Street, Birmingham. Vacancies at Manchester branch. Apply Springfield Lane Works, Salford, 3.

SITUATIONS VACANT—*contd.*

BROOK MOTORS, LTD., Electric Motor Manufacturers, Huddersfield, require an ASSISTANT in their Purchasing Department; a young man with practical Foundry training and knowledge of patternmaking, to deal with purchases of grey iron castings, both repetition and floor moulded.—Apply in writing, stating age and full details of experience.

ENTHUSIASTIC FOUNDRY CHEMIST, with sound knowledge of Core Binders and all Foundry Materials, required. To control and check raw materials and all production. Able to investigate and develop new products, and visit customers to demonstrate same.—Apply, with full particulars of training, previous employment, age, salary required, etc., in confidence, Box EF946, FOUNDRY TRADE JOURNAL.

ASSISTANT FOUNDRY FOREMAN required for small Steel Foundry, mechanised and jobbing. To be responsible for the layout of work, also sand control. Must have initiative and drive and a knowledge of modern techniques. State full particulars, where trained, also age and wages required.—Box AF947, FOUNDRY TRADE JOURNAL.

FOREMAN for Foundry employing about 12 skilled hands specialising in miscellaneous pipework and sections up to 2 tons weight, also platework and Slinging Machine work; must be experienced practical man in floor moulding, core making and cupola practice; not more than 45 years of age, and able to estimate moulding costs on piece work basis.—Apply in writing, stating full details of experience, salary required, etc., to EDWARD COCKEY & SONS, LTD., Garston Works, Frome, Somerset.

C. A. PARSONS & CO., LTD., Heaton Works, Newcastle-on-Tyne: ASSISTANT IRON FOUNDRY MANAGER. Applications are invited for the post of Assistant Manager, Foundry Department. The Foundry, which has been recently re-equipped, employs approximately 250 men. It handles iron castings up to 30 tons and non-ferrous castings up to 5 tons for the manufacture of Turbo-Alternator Plant of all sizes up to the largest. A considerable amount of machine moulding is also handled.—Applications, which should be addressed to PERSONNEL MANAGER, should give age, education and experience in chronological order.

VITREOUS ENAMELLER required for Service with leading frit manufacturers. Should have wide experience of sheet and cast W.P. and D.P., including good production record, be able to manage staff and train juniors, and to initiate sales. Adequate remuneration for suitable applicant.—Box VE939, FOUNDRY TRADE JOURNAL.

MANAGER required for Jobbing Grey Iron Foundry in Essex. House provided. Excellent prospects for man with sound technical knowledge and practical experience. The position also demands attention to commercial side, control of office, costings, etc.—Write fully, stating age and salary required, Box MR962, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*contd.*

IRONMOULDERS for loose pattern medium and heavy work. Top rates. —Apply F. H. CLARK & SON, LTD., Sutherland Road, Blackhorse Lane, Walthamstow, E.17.

PATTERNMAKERS wanted early after Christmas for Architectural and Commercial Foundry work. Write stating age, experience and salary required. Box 39, W.B.G., 39, Cheapside, London, E.C.2.

APPLICATIONS are invited from young men with ability and energy for Technical Staff positions in an alloy-steel Foundry using the shell mould and precision casting processes.

Applicants should have had experience in the following fields:—

(1) Either foundry methods, or metallurgy, including H.F. steel melting.
(2) Practical foundry management in a precision casting foundry or a small alloy steel foundry.

Applications to the SECRETARY, Osborn Precision Castings, Ltd., Clyde Steel Works, Sheffield.

WORKS ENGINEER.—A vacancy exists in a well-established Midland Ironfoundry for a Works Engineer. Applicants should have had experience with all classes of foundry plant, plant records, and factory regulations. Please apply, stating age, experience, and salary required, Box WE953, FOUNDRY TRADE JOURNAL.

A VACANCY exists for a FOUNDRY SUPERINTENDENT in a Ferrous and Non-ferrous Foundry in East Anglia. Applications are invited from experienced Foremen who feel they can handle a labour force of 60-70. The position will be progressive as expansion is intended.—Box AV954, FOUNDRY TRADE JOURNAL.

TECHNICAL REPRESENTATIVE required for Lancashire by a well-known Company in the chemical/metallurgical industry. Applicants should be between 25 and 40, with practical foundry experience and/or metallurgical knowledge. An exacting post calling for a high standard of intelligence. Well paid, with prospects for advancement in return for hard work. Car supplied. Superannuation scheme.—Box TR950, FOUNDRY TRADE JOURNAL.

FOUNDRYMAN required, experienced in ferrous and non-ferrous foundry practice, capable of training unskilled labour and apprentices in Moulding, Coremaking, Melting, etc. This position should appeal to a person over 50 years of age interested in developing good craftsmanship.—Applicants should give full details of education, past experience, and present salary to Box J.977, WILLING'S, 362, Grays Inn Road, London, W.C.1.

ESTIMATOR required for modern Aluminium Sand Foundry. Fully conversant with floor and machine moulding, able to carry out weight estimations. State full experience and salary required.—Apply WILLIAM MILLS, LTD., Friar Park Foundry, Wednesbury.